

INNAMINCKA REGIONAL RESERVE
BIRDS, MAMMALS & VEGETATION SURVEY 2018
BORE TRACK NORTH
~ REPEAT OF 2013 SURVEY ~

*A project undertaken by the Friends of the
Innamincka Reserves*



2013



2018

The Bore Track North, Innamincka Regional Reserve

REPORT ON THE BORE TRACK NORTH BIRDS, MAMMALS & VEGETATION SURVEY 2018 – REPEAT OF 2013 SURVEY

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REPORT ON THE BORE TRACK NORTH BIRDS, MAMMALS & VEGETATION SURVEY 2018 – REPEAT OF 2013 SURVEY

INTRODUCTION

A. PROJECT FIELD TEAM AND COORDINATOR

This project was carried out as a volunteer activity by members of the Friends of the Innamincka Reserves (FOIR). There was no external funding for the project.



Field Team: L to R - Mark Anderson, Merilyn Browne, Jenny Rolland, Euan Moore, Rose Treilibs, Vern Treilibs

Project Coordinator: Kate Buckley

B. BACKGROUND

In 2013 FOIR volunteers established a survey method which could be used to monitor the impacts of both short- and long-term changes in environmental conditions on populations of bird, mammal and vegetation species in the Innamincka Regional Reserve. Using this methodology, the volunteers obtained baseline survey data for an 80 km span of the Bore Track North¹. In subsequent years, similar surveys were conducted along roads radiating out from Innamincka: the Coongie Road in 2014², the Old Strzelecki and Loop Tracks in 2015³ and the Cordillo Downs Road in 2017⁴. In 2016, high rainfall prevented access to the Reserve

¹ FOIR Bore Track North Survey Project Report 2013

² FOIR Coongie Road Survey Project Report 2014

³ FOIR Old Strzelecki and Loop Tracks Survey Project Report 2015

⁴ FOIR Cordillo Downs Road Survey Project Report 2017

for a survey. In this report, results are presented for a repeat survey of the Bore Track North conducted in 2018 using the same methodology at the same sites as the 2013 survey.

The Bore Track North extends from Nappa Merrie Road south to Bollards Lagoon Station boundary. The vegetation in the area is mainly tussock grasslands on sand plains and low dunes with scattered low to medium height shrubs. There are few trees in the landscape with those present being mainly along water courses. In some areas the land rises to gibber plains with sparse vegetation. In the south there are ephemeral lakes and ponds that will hold water after rain.

While average rainfall is low (180 mm per annum), the Innamincka area is in a region of maximum rainfall variability for Australia. In 2010 this area experienced extreme rainfall in terms of scale and intensity, resulting in closure of several roads during 2010-2011 (Appendix VI). Following the extreme rainfall year in 2010, rainfall has been closer to average⁵. In June 2018, 24.9mm of rain was recorded at the Innamincka Park's office which would have resulted in new plant growth as noted for some of the transect surveys in this report.

The FOIR surveys provide data for monitoring changes to populations of terrestrial birds, mammals and vegetation as the weather conditions change between 'normal', dry and ecological boom. They also enable assessment of the impacts of other environmental changes such as mining, road-making and grazing.

C. APPROACH

Surveys were conducted along an ~80 km length of the Bore Track North within the Innamincka Regional Reserve, following as closely as possible the transects and methodology of the surveys conducted in 2013. Starting from the northern end of the Bore Track near Nappa Merrie Road, surveys were undertaken at nine census stops, every ~10 km along the track and covering differing vegetation types, finishing near the Bollards Lagoon Station boundary. Surveys at each census stop comprised transects along two 500 m-sided quadrants, one on each side of the track.

D. OBJECTIVES

1. To collect data systematically for bird, mammal and plant species, at a series of survey transects spanning ~80 km in total along the Bore Track North within the Innamincka Regional Reserve.
2. To relate species occurrence to short-term climatic and environmental variables.
3. To compare the survey data with that collected for the baseline Bore Track North survey conducted in 2013, assessing the impacts of longer-term changes in climate and environment on populations and species.
4. To use a bird survey technique equivalent to a 'fixed-route' survey as specified for the Birdlife Australia Atlas project.
5. To use these data to facilitate further monitoring of the change in population diversity and abundance as the conditions change to drier or wetter or due to other environmental impacts such as mining and road-making.

E. PROGRAMME OF RESEARCH

Surveys were conducted on 23-26 July, 2018.

⁵ Bureau of Meteorology

METHODS

1. Survey overview and terminology

The road was surveyed using the method used in 2013 and described below, travelling an average of 20-30 km per day along the track, with census stops at approximately every 10 km of track length. The survey method is adapted from methodology used by Rob Clemens and Richard Fuller (School of Biological Sciences, University of Queensland) for similar surveys in outback SA. The survey technique is equivalent to a 'fixed-route' survey as specified for the Birdlife Australia Atlas project.

Key terminology (see also diagram in Fig. 1 below):

A **census stop** is one of the points placed at intervals along the road. The census stop forms a central point for conducting surveys in the surrounding habitat. The locations of all census stops are provided as GPS waypoints. If the exact location of the waypoint proves to be inaccessible, then the point is established along the road closest to the waypoint location.

A **corner point** is one of the corner points of a survey square.

A **transect** is one of the sides of a survey square.

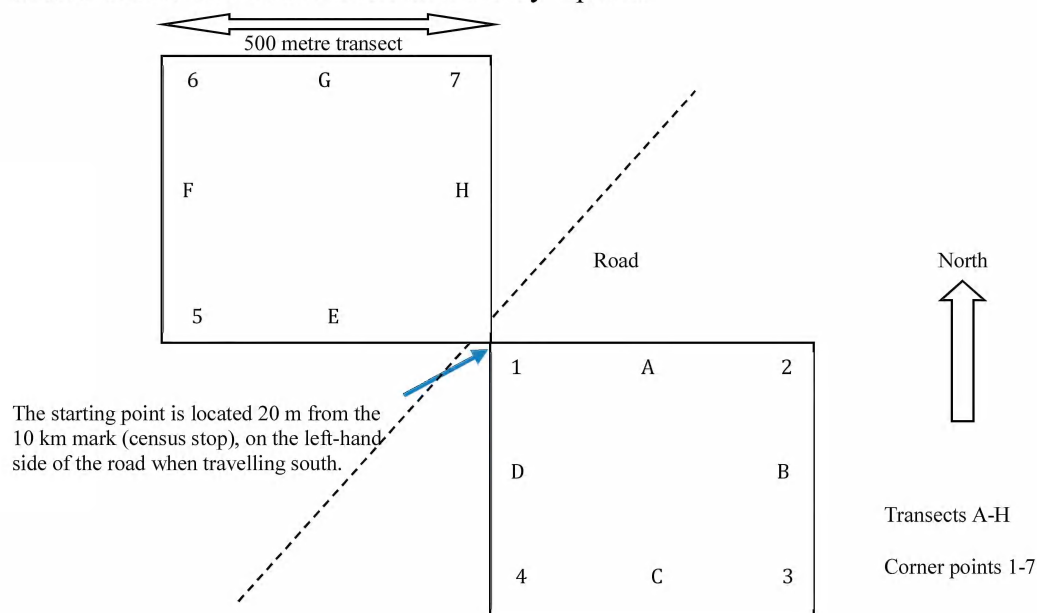


Fig. 1. Diagram of survey transect squares for each census stop

2. A typical day

A typical day commences at first light, travelling to the first census stop, surveying until around 11am-noon, when bird activity begins to decline noticeably. After a break during the heat of the day, surveys continue late in the afternoon when bird activity has increased again. Key equipment items for the surveys are listed in Appendix VIII.

3. Communication

The team maintains contact using vehicle and hand-held UHF radios.

4. Briefing session

Before commencing surveys, leaders should brief the group on GPS technique for the survey

and how to complete the survey sheets to ensure consistent data collection. The GPS co-ordinate system used is UTM and members should be familiar with how to select this on their GPS. A practice field session on using the GPS to complete a square is recommended. Two alternative methods for using the GPS to navigate a survey square are given in Appendix VII.

5. Survey work at each census stop

The following protocol was adopted for the baseline surveys and is being followed as closely as possible in future repeat surveys. If there are sufficient members in the group, half the group will take the east survey and the other half the west survey at each census stop.

(i) Upon arriving at a census stop, park the vehicle safely and place a hazard indicator (e.g. witch's hat) behind the cars if deemed necessary. Walk off the road 20 m from the census stop, left of the road when travelling south. Mark this starting location in the GPS (see diagram above, Fig. 1). Erect star dropper and attach metal tag with identifying detail e.g. 2018 FOIR 1 (see photos below). This is corner point 1 in Fig. 1. For repeat surveys, relocate the star dropper that was put in place during the original survey. Attach an additional metal identifier tag for the current survey.

(ii) Write the co-ordinates onto the survey sheet to ensure they are not lost and note the weather details. Note down the dominant habitat type in the area surrounding the starting point (corner point 1). Choose from gibber, grassland, dunes, shrubland, lignum, woodland, wetland. Record dominant species in the vegetation if known. Take a photo of the survey sheet and then take representative



photographs of the habitat at the starting point, one towards the centre of the eastern transect square and one towards the centre of the western transect square. When walking around each transect square in a clockwise direction (as was done for this survey), representative habitat photos are also taken at each corner, first towards the right (into) and then the left (outside) the square.

(iii) Using a GPS to guide you, walk east for 500 m, conducting a line transect survey as you go (see methods below under 6. Line Transect method and Appendix VII - Using a GPS to navigate transect squares). As each transect line follows grid north/south or east/west, maintaining a constant grid northing or easting as appropriate allows the navigator to stay on the transect line. If your route must deviate around obstacles etc., return to the transect once the obstacle has been passed.

(iv) At 500 m from the starting point, i.e. at corner point 2, write the co-ordinates onto the survey sheet, note the time, and take a photo of the survey sheet and then of the habitat towards the centre and outside of the transect square as before. Continue in this fashion following the scheme in the diagram until 8 line transects have been completed. For repeat surveys, if copies of the original corner photos are available, use landmarks in these photos to help line up the repeat photos.

(v) Aim to complete all the survey work for each census stop within 1.5-2 hours if working as two teams.

6. Line Transect method

(i) Walk slowly along the transect line, looking and listening for birds. Pay careful attention for birds that are flushed from ground cover as you approach. For each individual or group of birds seen, note down (a) the species including age and sex if determined, (b) the number of birds in the group, (c) whether you heard and/or saw the birds, and (d) any evidence of breeding or feeding activity. Use a separate survey sheet for each 500 m transect. Avoid double counting on adjacent transects.

(ii) If you need to stop to check birds do so but try to keep a roughly even averaged slow walking pace throughout the transect.

(iii) There is no maximum distance for recording birds – every bird detected should be noted.

(iv) Note down any change in the dominant habitat type through which the transect passes (write across the line in the data collection columns). Record dominant species in the vegetation if known. Take representative photographs of the habitat. Ensure there is a photo of the survey sheet prior to the habitat photo so it is always clear which transect the photo belongs to.

(v) Note (write across the line in the data collection columns) and photograph any tracks or other traces and sightings of mammals/reptiles/birds. A photograph of tracks showing the gait of the animal/bird (i.e. set of prints) together with a ruler or measuring card (see photo) is useful for identification. A GPS reading for any significant sightings should be recorded.



Photograph of small mammal tracks with ruler

(vi) Record any threats or impacting factors noted e.g. soil erosion, weeds e.g. Buffel Grass (*Cenchrus ciliaris*), Mimosa Bush (*Vachellia farnesiana*, previously *Acacia farnesiana*), feral animals, mining, road-making, grazing, fire, water/drainage disturbance, strong wind.

7. Incidental surveys while driving between census stops

(i) When driving between census stops, sightings such as a particularly large group of birds, something very rare, or anything in the environment relevant to the aims of the study is recorded. These incidental surveys include a GPS reading followed by a 5 minute point count. The reason for the survey is noted e.g. “Cinnamon Quailthrush crossed the road” and the surveys entered as an incidental survey in the Birdlife Australia Atlas database (Birdata).

(ii) Any wetlands that are visible from the road are surveyed with a count of any water-birds present (2 ha/20 min, 500 m radius or 5 min incidental survey as appropriate). The GPS location is recorded and the wetland photographed.

(iii) A count of all mammals (feral and domestic) is recorded.

(iv) Make a note of any items left on or near the road such as tyres, garbage or equipment and record any threats (as described above, 6(vi)).

RESULTS AND DISCUSSION

As for the baseline survey, 9 census stops were surveyed along the Bore Track within the Innamincka Regional Reserve, following as closely as possible the transect routes for the 2013 survey. The exact locations of the census stops and the co-ordinates for the survey points for the 2018 survey are given in Appendix I.

A. BIRD SURVEY DATA

Bird surveys were conducted over four days, 23-26 July, 2018. Surveying was carried out before noon or after 3pm when conditions were cooler and winds generally not so strong. The time of day for surveys at each site was similar to that for the baseline surveys in 2013. Details of the bird survey data are given in Appendix II and summaries of the data are presented in the tables and figures below showing comparisons with the 2013 survey data.

During the 2018 survey a total of 26 species (544 individuals) was recorded across the nine survey sites. Only one species, Singing Honeyeater was found at all nine census stops with an average of 4.67 individuals per census stop. The overall density of birds was low with 15.11 individual birds across all species being recorded per km transect. The number of species was also quite low with most species observed being either arid zone specialists or with large home ranges. Irrespective of this, neither Cinnamon Quail-thrush nor Gibber Bird were recorded during the survey in spite of this area being prime habitat for both species. There were no records of budgerigars which are highly nomadic.

Census stop 3 stands out from the other census stops as the habitat is almost entirely gibber plain whereas all other census stops are various forms of hummock grassland and open woodland on dunes or dune swales. Three of the bird species recorded at this census stop were Emu, Wedge-tailed Eagle and Brown Falcon, all species that tend to range over a wide area. This site was the only location that appeared to have had some rain in recent months, indicated by the growth of seedlings of ephemeral herbs and saltbushes.

Across the remaining census stops the species that were most widespread were all arid land grassland or grassy woodland specialists. These included Zebra Finch, White-winged Fairywren, Black-faced Woodswallow, Singing Honeyeater, Crimson and Orange Chats, Willie Wagtail and Chirruping Wedgebill. These species were all amongst the most frequently encountered during the survey. Of these, only White-winged Fairywren, Zebra Finch and Singing Honeyeater were present on the gibber plain (census stop 3).

Some birds regularly seen in this area were quite patchy in their distribution. These species included Nankeen Kestrel, Galah, Cockatiel, Chestnut-crowned Babbler, Australian Magpie, Australian Raven and Little Crow (including records for Corvid), White-backed Swallow, Australian Pipit and Brown Songlark.

The only evidence found of birds breeding was a Bourke's Parrot nest at census stop 6. This nest was in the hollow of a short spout leading into the main trunk of a small dead tree, probably mulga, *Acacia aneura*. It was approx. 1.2 m above ground level and contained three eggs.



Bourke's Parrot
Photo by Euan Moore

Table 1: Summary of counts by census stop for each bird species – 2018 survey							
Species	No. of census stops where present	Total count	Min. count /stop when present	Max. count /stop when present	Average /stop when present	Average for all 9 stops	Birds per km of transect
Emu	1	17	17	17	17.00	1.89	0.47
Wedge-tailed Eagle	2	3	1	2	1.50	0.33	0.08
Brown Falcon	4	4	1	1	1.00	0.44	0.11
Nankeen Kestrel	2	2	1	1	1.00	0.22	0.06
Banded Lapwing	1	12	12	12	12.00	1.33	0.33
Crested Pigeon	7	19	1	6	2.71	2.11	0.53
Galah	2	4	1	3	2.00	0.44	0.11
Cockatiel	1	2	2	2	2.00	0.22	0.06
Bourke's Parrot	1	1	1	1	1.00	0.11	0.03
White-winged Fairywren	8	52	2	12	6.50	5.78	1.44
Singing Honeyeater	9	43	1	10	4.67	4.67	1.19
Crimson Chat	5	40	3	18	8.00	4.44	1.11
Orange Chat	4	22	2	13	5.50	2.44	0.61
Red-capped Robin	2	2	1	1	1	0.22	0.06
Chirruping Wedgebill	6	27	1	7	4.50	3.00	0.75
Chestnut-crowned Babbler	2	10	4	6	5.00	1.11	0.28
Willie Wagtail	6	11	1	4	1.83	1.22	0.31
Black-faced Woodswallow	8	65	2	15	8.12	7.22	1.81
Australian Raven	3	7	1	4	2.33	0.78	0.19
Little Crow	3	6	1	3	2.00	0.67	0.17
Crow/Raven sp.	4	12	1	10	3.50	1.56	0.33
Australian Magpie	1	1	1	1	1.00	0.11	0.03
White-backed Swallow	4	10	1	4	2.50	1.11	0.28
Australian Pipit	4	5	1	2	1.2	0.56	0.14
Brown Songlark	1	3	3	3	3	0.33	0.08
Zebra Finch	6	162	4	40	27.00	18.00	4.5
Total Species		26⁶	5	17	11.33	11.33	
Total Individuals		544	17	102	60.44	60.44	15.11

Changes since 2013

The original survey conducted in 2013 was shortly after the boom in activity following the floods of 2010-2011. Also at that time, mainly due to the large amount of biomass, the impact of grazing was less obvious than in 2018. In 2018 a much greater proportion of the

⁶ Excludes species where full identification was not possible i.e. unidentified corvids

area was being grazed which is probably the result of new water points for cattle enabling them to spread further across the landscape.

In the summers of 2011/12 and 2012/13, some sites had been burnt by the extensive wildfires that covered part of the survey region. By 2018 this impact was less obvious although the remains of burnt *Triodia* tussocks and woody vegetation could still be seen on some transects. There was also *Triodia* regeneration in some of the burnt areas.

Overall there was a 21% decline in the total number of species recorded during the survey. This is accounted for by 13 of the 33 species recorded in 2013 not being recorded in 2018. Six species were recorded in 2018 for the first time and twenty species were recorded on both surveys. The decline in the number of species was greatest at the northern end of the Bore Track with species numbers being more stable in the south.

There was a 56% decline in the total number of individuals that were recorded between the two surveys. The decline in the number of individuals was greatest in the north and at those census stops closest to the Moomba Rd in the middle of the survey route. The declines in both species and number of individuals may be due to the higher grazing pressure from cattle in the areas where these declines are greatest.

Emus were not recorded during the 2013 survey, but in 2018 a flock of 15 birds as well as 2 lone individuals were recorded on the gibber plains at census stop 3. This species is quite nomadic and will cover large areas of the country in their search for food and water.

All raptor species showed a decline in numbers with the greatest decline being for the Nankeen Kestrel which dropped from 23 individuals recorded in 2013 to just two in 2018. Wedge-tailed Eagles also showed a decline of more than 50% across the survey. The raptor to show the least change was Brown Falcon whose numbers could be regarded as stable across the two surveys.

Within the pigeons and doves, primarily granivorous, only Crested Pigeons were relatively stable in numbers between the two surveys. Neither of the two small doves, Diamond and Peaceful, were recorded during the 2018 survey. The nomadic Flock Bronzewing was not recorded in 2018.

Parrot and cockatoo numbers were much lower in 2018. Large numbers of Galahs, Cockatiels and Budgerigars were recorded in 2013. In 2018 there were no Budgerigars and only four Galahs and 2 Cockatiels. Little Corellas which are present in large numbers along Cooper Creek have never been recorded in significant numbers during our Bore Track Surveys.

Within the honeyeater family there was a decline of about 33% for Singing Honeyeater while both Spiny-cheeked Honeyeater and Yellow-throated Miner were present in 2013 but not 2018. In contrast, Crimson and Orange Chats were not present



Clockwise from top left: Black-faced Woodswallow, Crimson Chats, Wedge-tailed Eagle, Brown Falcon.

Photos by Marilyn Browne

in 2013 but were some of the more common birds in 2018. Chirruping Wedgebill, Chestnut-crowned Babbler and Black-faced Woodswallow, all arid zone specialists, were present in increased numbers in 2018. This is in stark contrast to most other species.

There was a decline of about 60% for the two corvid species, Little Crow and Australian Raven, that are common in the area. Not all corvids were identified to species level as from a distance this is only possible if the bird calls.

The other major decline was for Zebra Finch where numbers declined by about 65%. This species is reliant on accessible water and is able to make use of water points established for cattle that may not be accessible to some other species. This species was found at fewer locations in 2018 which may be caused by less available water.

Table 2: Comparison of numbers of birds observed for each census stop for baseline (2013) and repeat (2018) surveys						
Census Stop	2013		2018		% change from baseline **	
	No. of species*	No. of individuals	No. of species*	No. of individuals	No. of species*	No. of individuals
1	16	123	11	46	(31%)	(63%)
2	19	372	12	67	(37%)	(82%)
3	4	8	9	29	125%	263%
4	15	339	17	102	113%	(70%)
5	13	55	12	71	(8%)	29%
6	17	169	15	51	(12%)	(70%)
7	11	45	10	98	(09%)	118%
8	14	82	10	63	(29%)	(23%)
9	10	32	5	17	(50%)	(47%)
Total	33	1225	26	544	(21%)	(56%)
Average	13	136	11	60	(15%)	(56%)

* Excludes unidentified corvids

** Decreases in parentheses

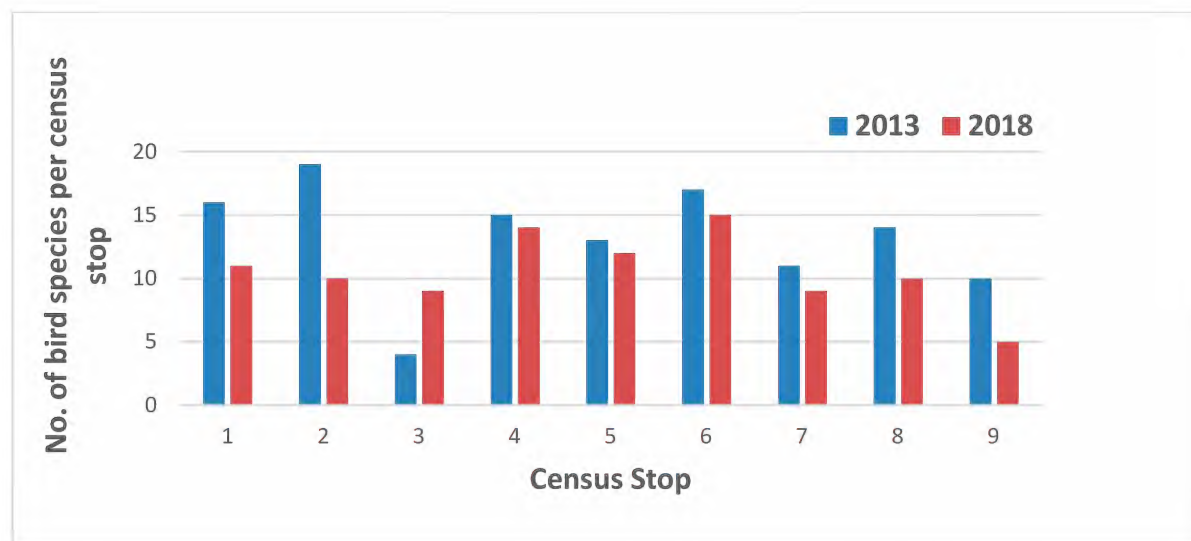


Fig 2. Comparison of no. of bird species at each census stop for 2013 and 2018 surveys

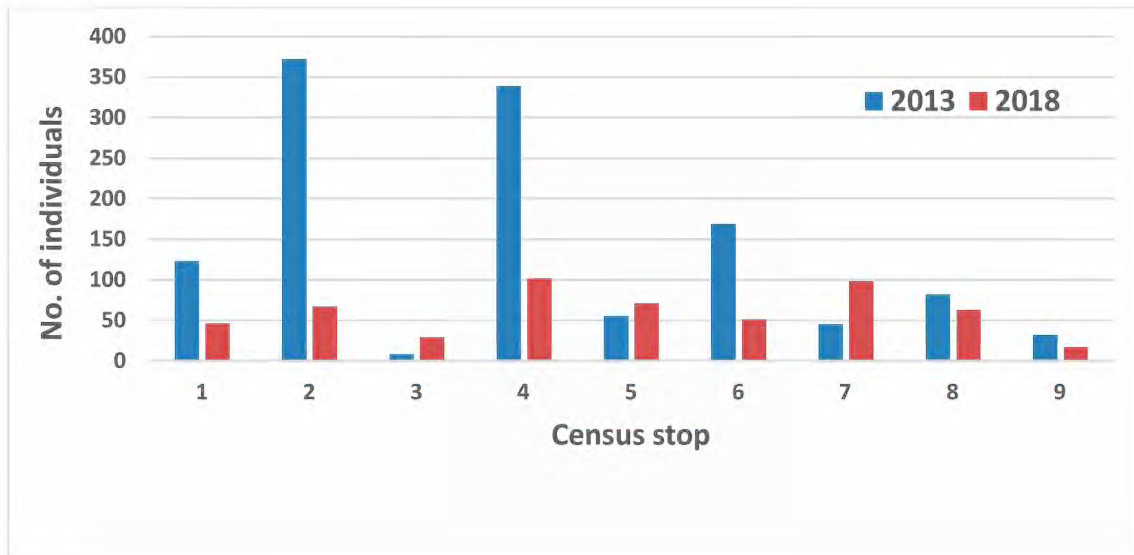


Fig 3. Comparison of no. of individual birds for each census stop for 2013 and 2018 surveys

Name	2013 No. of census stops where present	2013 Count	2013 Birds per km of transect	2018 No. of census stops where present	2018 Count	2018 Birds per km of transect
Emu			0.00	1	17	0.47
Wedge-tailed Eagle	2	7	0.19	2	3	0.08
Black-shouldered Kite	1	1	0.03			0.00
Brown Falcon	3	5	0.14	4	4	0.11
Nankeen Kestrel	7	23	0.69	2	2	0.06
Banded Lapwing			0.00	1	12	0.33
Little Buttonquail	1	1	0.03			0.00
Flock Bronzewing	1	4	0.11			0.00
Crested Pigeon	6	19	0.53	7	18	0.53
Peaceful Dove	1	2	0.06			0.00
Diamond Dove	2	6	0.17			0.00
Little Corella	1	4	0.11			0.00
Galah	3	143	3.97	2	4	0.11
Cockatiel	1	35	0.97	1	2	0.06
Bourke's Parrot			0.00	1	1	0.03
Budgerigar	3	190	5.28			0.00
Purple-backed Fairywren	1	3	0.08			0.00
White-winged Fairywren	7	46	1.28	8	52	1.44
Singing Honeyeater	8	64	1.78	9	42	1.19

Spiny-cheeked Honeyeater	3	3	0.08			0.00
Yellow-throated Miner	1	2	0.06			0.00
Crimson Chat			0.00	5	40	1.11
Orange Chat			0.00	4	22	0.61
Red-capped Robin			0.00	2	2	0.06
Cinnamon Quail-Thrush	1	1	0.03			0.00
Chirruping Wedgebill	4	10	0.28	6	29	0.75
Chestnut-crowned Babbler	1	4	0.11	2	10	0.28
Willie Wagtail	7	27	0.75	6	11	0.31
Black-faced Woodswallow	8	47	1.31	8	65	1.81
Masked Woodswallow	2	6	0.17			0.00
White-winged Triller	1	1	0.03			0.00
Little Crow	7	31	0.86	3	6	0.17
Australian Raven	5	18	0.50	5	7	0.19
Crow/Raven sp.	6	17	0.47	2	12	0.33
Australian Magpie	2	2	0.06	1	1	0.03
White-backed Swallow	5	8	0.22	4	10	0.28
Australian Pipit	5	8	0.22	4	5	0.14
Brown Songlark	2	12	0.33	1	3	0.17
Zebra Finch	8	464	12.89	6	162	4.50
Total Individuals		1214	33.72		544	15.11

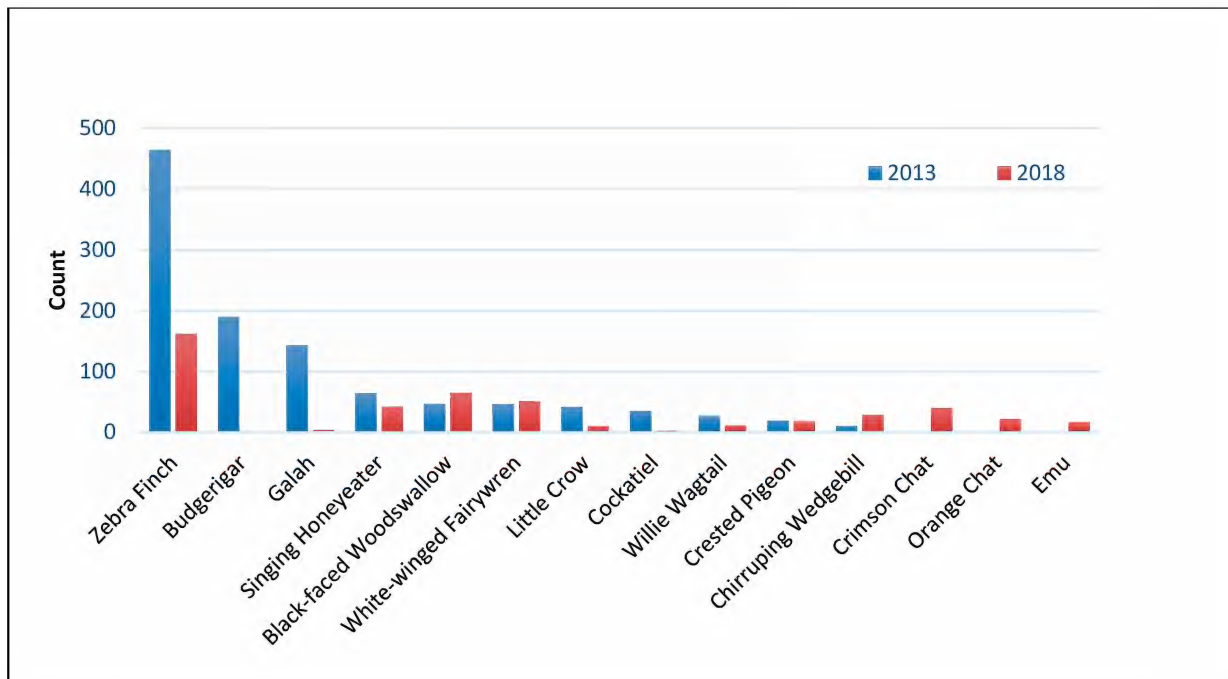


Fig. 4. Comparison of counts for the 14 top-listed birds for the 2013 and 2018 surveys

B. HABITATS – 2018 REPORT AND COMPARISON WITH 2013 SURVEY

Dune/swale and sand plain

These areas were showing the effects of drought. Most tussock grasses consisted of dead leaves and stems although the root stock may have still been alive but dormant. Short-lived shrubs such as *Crotalaria*s and *Verbena* were largely dead. While the *Acacias* were still alive, many were clearly under stress.

The areas that had been burnt in wildfires prior to the 2013 survey were showing signs of recovery. Seedlings of *Triodia* had germinated and were now starting to form hummocks. There is still a considerable way to go before these areas fully recover. *Triodia* extent is still a small fraction of what it would have been prior to the fires.

Clay pans

In the south of the survey area there are a number of clay pans which will hold water after rain. The vegetation around the edge of these remains in good condition. The vegetation across the clay pans themselves, mainly Swamp Canegrass, is considerably reduced.

Gibber plains

The gibber plains at census stop 3 are in relatively good condition. This area has benefited from some localised rain in the preceding months. As a result, ephemeral plants have germinated between the gibbers. These plants are mostly less than 10 cm high.

Comparison with 2013 survey

Table 4: Bird species by vegetation type at census stops					
Census stop	Topography	Vegetation types		No. of bird species	
				2013	2018
1	Dune/Swale	Acacia spp., Canegrass	Low tussock grassland, scattered trees	16	11
2	Dune	Hakea, tussock grass		19	10
3	Gibber Plain	Sparse tussock grassland	Occasional low shrubs	4	9
4	Dune/Swale	Tussock grassland		15	14
5	Dune/Swale	Tussock grassland	Whitewood trees	13	11
6	Dune/Swale	Tussock grassland	Whitewood	17	15
7	Dune/Swale	Tussock grassland		11	9
8	Dune/Swale	Tussock grassland	Open shrubland	14	10
9	Dune/Swale	Tussock grassland	Dune shrubland	10	5

A comparison of the number of bird species by vegetation type at each census stop is shown in Table 4 above, and photographs taken from the corner points of each survey quadrant showing the habitats and a comparison between the 2013 and 2018 surveys are given in Appendix III. At most census stops, there was a significant reduction in ground cover and small shrubs. The number of bird species at each census stop was lower in the 2018 repeat survey compared with the 2013 baseline survey, except at census stop 3 where an increase was observed. Census stop 3 was on gibber plains which is a different habitat type to other census stops and which appeared to have benefited from some recent localised rain.

C. FLORA

The approximately 80 km of the Bore Track surveyed generally runs in a north-south direction, traversing a region of north-south sand dunes and swales. The track is intersected in the middle by an area of gibber and stony rise. The low rainfall received in the area in the last 18 months prior to the survey was reflected in the very sparse vegetation cover seen across the 80 km length of the Bore track especially when compared to the previous survey done 5 years earlier (see corner point comparison photographs in Appendix III). Any patches of forbs and grasses usually in the bottoms of swales or clay pans were generally grey and either dead or dying. The estimated percentage vegetation cover varied from 10% to 60%, with the most common being 40% cover. Large bare areas were regularly seen on the dunes and swales as well as in the clay pans and gibber rises. However, some rain must have fallen in the previous 4-5 weeks, as regrowth was observed for some plants (e.g. a green flush is seen at census stop 3 corner point 1, and increased growth of small shrubs at census stop 7 corner point 2).

Small areas of emergent forbs and herbs were also seen sporadically in varying densities across the whole region but were generally more advanced in the north, grading to minimal in the south.



Polycalymma stuartii

Large trees greater than 4 metres in height were rarely seen. On two occasions Coolibahs were encountered. The first along an ephemeral creek line which dissected the gibber plain and the second on a Coolibah floodout about 80 km south from the start. The latter was showing some Coolibah (*Eucalyptus coolabah*) regeneration, perhaps as a result of the significant rains in 2010 (~730mm) and 2016 (~300mm). Isolated Bloodwoods (*Corymbia terminalis*) were seen on two of the southern census stop transects. Some Hard Spinifex (*Triodia basedowi*) and Sandhill Grevillea (*Grevillea stenobotrya*) were still showing signs of previous fires which occurred at least 7 years ago.

There were two different floristic communities associated with the different landforms. These ranged from:-

- 1) Low open woodland on the dunes and swales, to
- 2) Sparse grasslands and ephemeral herb fields associated with clay pans, gibber and stony rises.

Similar low open woodland vegetation was seen on the dunes, swales and interdunal sand plains. The percentage vegetation cover on the dunes and swales varied from 15% to 60% with large bare patches of sand regularly seen. On the deep red sands of the larger dunes in the north some taller trees dominated such as Whitewood (*Atalaya hemiglauca*) and Sour

Plum (*Owenia acidula*). Further south, Mulga (*Acacia aneura*) and Elegant Wattle (*Acacia victoriae*) were occasionally seen. On the lower dunes in the far south, trees gave way to low open shrubs such as Sandhill Grevillea (*Grevillea stenobotrya*) and Hop Bush (*Dodonea viscosa* sp.). Needle Hakea (*Hakea leucoptera*) was the most common tall shrub throughout.

Hard Spinifex (*Triodia basedowii*) most frequently dominated the low open understorey on the dunes and swales. This was often interspersed with a sparse cover of Sandhill Canegrass (*Zygochloa paradoxa*), Desert Rattlepod (*Croatalaria eremea*) and isolated shrubs such as *Eremophila longifolia*, *Er. glabra*, *Acacia tetragonaphylla* and *Senna artemesoides* sp. Following the recent patchy rains, a sparse scattering of forbs and herbs had emerged such as *Ptilotus* sp. (*Pt. polystachyus*, *Pt. sessiflorus*, *Pt. latifolia*), *Polycalymma stuartii*, *Rhodanthe moschata*, *Goodenia lunata* and *Senecio gregorii*. There were also scattered patches of *Sclerolaena* sp. including (*Sc. bicornis*, *Sc. muricata*, *Sc. longicuspis*), some *Maireana* sp., *Atriplex* sp., and *Rhagodia* sp. In the south, *Calandrinia* sp. were struggling to emerge.

Where the interdunal areas were large and flat and had become claypans, they often formed ephemeral interdunal wetlands after rain. At the time of the survey they were dry cracking clay pans with sparse, dry, grey forbs and were either completely bare or had some remnant grasses such as Umbrella Canegrass (*Leptochloa digitata*), Swamp Canegrass (*Eragrostis australasica*) and Golden Goosefoot (*Chenopodium auricomum*).

The gibber rises encountered in the middle transects were largely bare of vegetation with an average density cover of between 5 and 10%. There was a very sparse covering of dried grasses, ephemeral herbs and forbs such as *Sclerolaena bicornis* with very occasional isolated emergents such as *Senna artemesoides* sp., *Hakea leucoptera* or *Atalaya hemiglaucula*. Recent rain had stimulated the germination of ephemeral herbs.



Emergent herbs on a gibber plain

Ephemeral watercourses were generally not encountered on the transects.

Photographs of flora seen on the different transects are given in Appendix IV and a full list of flora recorded during the 2018 survey is given in Appendix V.

D. MAMMALS

1. Cattle

The whole of the survey area is subject to grazing by cattle from Innamincka Station. Cattle were observed at census stop 3 and between census stops 7 and 8. There was heavy tracking by cattle on census stops 1, 3, 4, and 5. These census stops are the ones closest to water supplies for the cattle. Recently dead cattle were seen at census stops 1 and 3, likely due to the impact of drought and more intensive grazing. Overall, these observations and the corner point photo comparisons between 2013 and 2018 indicated that cattle grazing was more intensive compared with the 2013 survey.

2. Feral horses/donkeys

As for the 2013 survey, there was evidence for feral horses and/or donkeys in the area. Horse or donkey tracks and dung were seen at census stops 7 and 9, both in the southern part of the

survey. At census stops 1 and 7 there was a dung pile used by stallions to mark their territory. A mob of horses approached our night-time camp near census stop 7 but were unable to be counted.

3. Rabbits

No rabbits were seen during the survey and only two active warrens were seen at census stops 1 and 4. Fresh rabbit scats were seen at census stop 2. Inactive warrens were seen at census stops 1, 2, 4 and 9. Most warrens were in the northern part of the survey area. Compared with the 2013 survey, rabbit numbers appeared to be lower, likely due to the lower rainfall and food supply.

4. Dingo

One dingo was observed at a puddle near a tank at census stop 1, but there were numerous tracks matching dingo foot prints seen during the survey (census stops 1, 4, 5, 6 and 7). Dingo numbers appeared to be similar to those for the 2013 survey.

5. Cat

No cats were seen on the survey but some possible cat tracks were seen at census stop 2 and a scat at census stop 7. It is highly likely that feral cats are in the area as they are seen frequently in the Innamincka region. They pose a major threat to the small mammals, birds and reptiles.

6. Fox

A possible fox scat was observed at census stop 7.

7. Camel

There was no evidence of camels seen in the area during the survey.

8. Kangaroos

As for the 2013 survey, low kangaroo numbers (mainly Red Kangaroos) are present in the area. No kangaroos were seen on the survey, but some kangaroo tracks were seen (census stops 7 and 9), mainly in the southern part of the area surveyed.

9. Other mammals

No other mammals were seen on the survey. However tracks of small mammals (possibly Long-haired rat, mice and small marsupials) were frequently seen on soft sand and dunes. Many small mammal warrens of the size for Long-haired rats were seen, usually at the base of a *Triodia* hummock. These findings were similar to those for the 2013 survey.

E. REPTILES AND AMPHIBIANS

Reptiles are generally not very active at the time of year when the surveys are carried out. Only one reptile was observed during the survey, the skink *Ctenotus regius*. However, lizard tracks, particularly those of small dragons, were seen at all census stops and a possible small snake track was seen at census stop 2.

No amphibians were recorded during the survey or at other times during the time in this area.

F. INVERTEBRATES

There were many active ant nests and termite mounds seen on the survey (see photos in Appendix IV). Occasional beetles were seen and grasshoppers were present in low numbers. A large caterpillar (*Psolidostetha banksiae*) was seen feeding on Hakea at census stop 6.



Psolidostetha banksiae

G. ARCHAEOLOGICAL SITES

The Innamincka area is of great aboriginal historical importance. On this survey, stone flake sites were observed in sand blowouts at three census stops (1, 2 and 3) indicating areas for stone tool working, and a grindstone fragment was seen at census stop 8.

No European archaeological relics were found.

H. THREATS AND POTENTIAL IMPACTING FACTORS

1. Cattle grazing

The whole survey area is subject to cattle grazing. Infrastructure related to the grazing industry was encountered during the survey. This included cattle yards, large tanks for stock watering and associated pipelines at census stop 1. More distant infrastructure (yards and tanks) was seen at other points along the track.

Grazing was heaviest near water points resulting in degradation of the natural ground cover and loss of small shrubs. Comparison with the 2013 survey photographs demonstrate striking evidence of increased grazing at many sites in 2018. Heavy cattle tracking was seen at many census stops. This loss of habitat and cover for small ground dwelling animals and birds is likely to be having a major impact on their breeding success and numbers.

2. Soil Erosion

Deep erosion channels and washouts were seen, often associated with excessive cattle tracking between water points and sometimes with vehicle tracks. Continued excessive grazing is likely to exacerbate this problem, with loss of the fragile algal crust essential for stabilising the sand and enabling the growth of ground cover plants.



Erosion channels

3. Weeds

As in the 2013 survey, Buffel Grass was observed at census stop 4 along the creek line. This infestation starts north of the census stop where the track crosses the creek and follows the creek line and track south for a few kilometres to where the creek fans into a sand plain. In the upper reaches of the creek the Buffel Grass is spreading out across the dunes for about 150m on the eastern side.



Buffel Grass along creekline

No other significant weeds were recorded during the survey.

4. Feral animals

As for the 2013 survey, the density of feral animals in the area appeared to be low. Tracks, scats and other signs of several feral animal species were recorded as noted above and shown in the photos in Appendix IV.

5. Mining, tourism and other human activity

Numerous old and current vehicle tracks cross the survey area. Usage of the southern section of the Bore Track has declined markedly since access across Bollards Lagoon Station was restricted in 2012. Mining traffic is a major user of the Bore Track for about 10 km north and south of the Moomba Rd, however private mining roads provide the main mining access. Roads often have major impact on natural water drainage flows and ephemeral wetlands and can be a focal point for accelerated erosion as is evident in the vicinity of census stop 4.

Old survey marker posts were seen at census stops 8 (tag number HO8?? 91 CZF KP264) and 9 (tag number 89CDT VP313). At census stop 7, a vertical pipe with a yellow cap (label on top: TEST STATION) was seen near a gas-line.

Compared with the 2013 survey observations, the level of litter and discarded equipment items was pleasingly low.

6. Fire

Extensive wildfires had affected this area in 2010-2012. Many of the larger trees and shrubs have still not recovered from fire damage in the affected areas. *Triodia* grasslands are showing some signs of recovery, although hummocks are still small and the stumps of burnt hummocks are still visible. These observations confirm the major impact of fire on these habitats and the very slow recovery that follows.

CONCLUSIONS

FOIR volunteers have conducted a series of bird, mammal and vegetation surveys along several road routes of the Innamincka Regional Reserve, radiating out from the vicinity of Innamincka. The Bore Track North was surveyed in 2013, the Coongie Road in 2014, the Old Strzelecki and Loop Tracks in 2015 and the Cordillo Downs Road in 2017. In 2018, the volunteers repeated the survey of the Bore Track North to commence assessing long-term changes from baseline data.

The data collected for these surveys document ecologically important areas with extensive floral attributes and valuable habitats for resident and nomadic faunal species. The surveys also point to current and potential threats to the integrity of these ecosystems that require ongoing surveillance.

Comparison of data from this 2018 repeat survey of the Bore Track North with the baseline 2013 data shows significant decreases in bird diversity and numbers as well as reduced ground cover and small shrubs. While the 2013 survey followed periods of heavy rainfall in the previous 2 years, the 2018 survey followed more 'normal' rainfall levels. This together with increased cattle grazing in the survey area (as evidenced by more marked cattle pads, dead cattle, and more water points), likely were the major factors influencing the overall survey findings. Cattle pads were forming erosion channels in several places. The flush of new growth of herbs and forbs seen at some census stops followed recent moderate rains but whether this continues to more established ground cover would depend on continued rainfall. Slow recovery of *Triodia* and *Grevillia sp.* from wildfires several years previously was noted. Borrow pits for road materials and new power lines were observed, but pleasingly, little litter or discarded equipment items were noted on the surveys. Feral animal numbers appeared to be low and Buffel Grass was the only significant weed impacting the area.

The survey data and information gathered provide a valuable resource for development of management plans for the region. It is recommended that repeat surveys continue to be conducted at least every 5 years to detect trends in wildlife numbers and habitat condition and to assess the impacts of both short- and long-term changes in environmental conditions on the flora and fauna of the Innamincka Regional Reserve.

APPENDIX I – LOCATION OF CENSUS STOPS

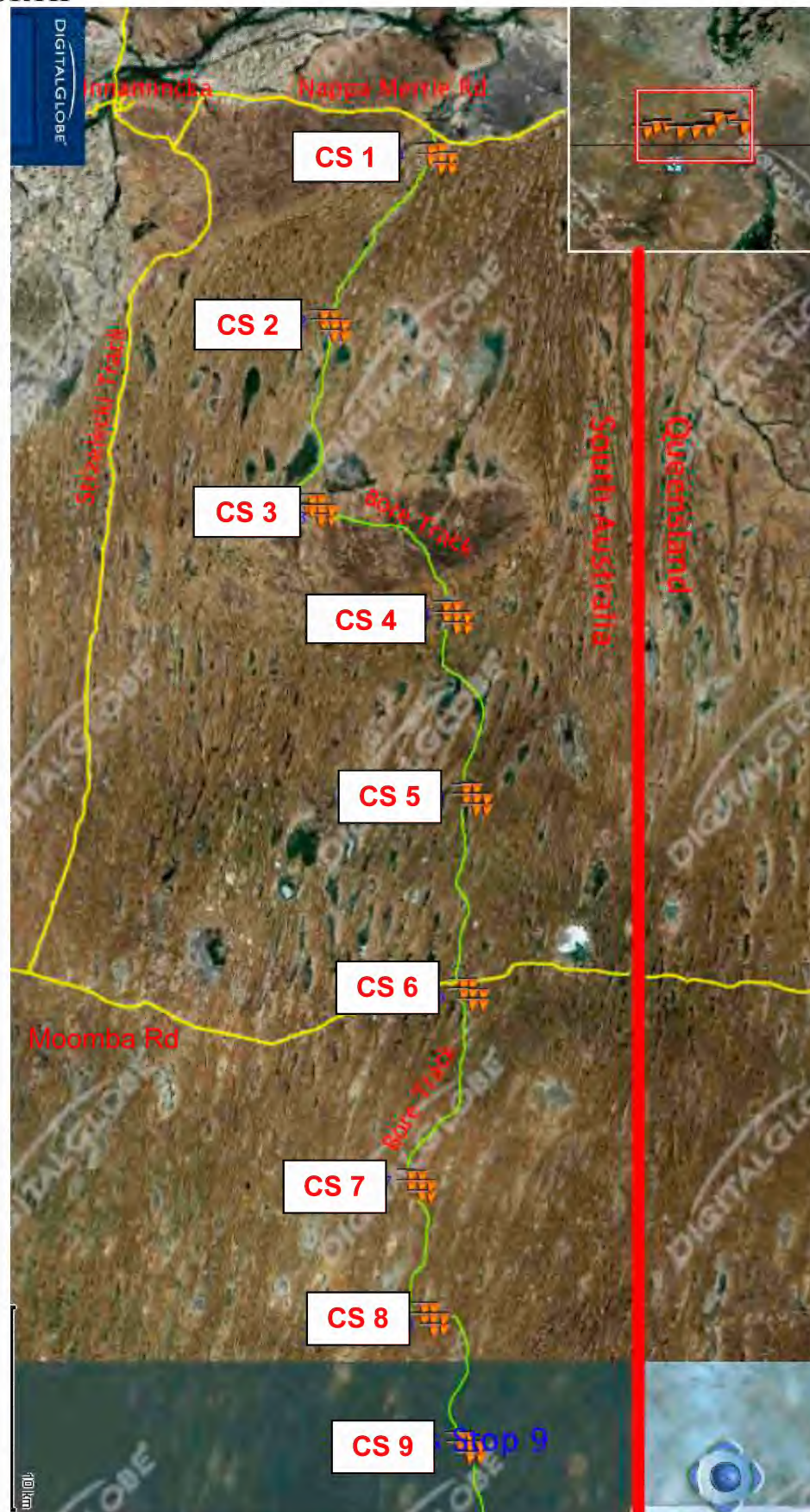
A. CENSUS STOP AND CORNER POINT CO-ORDINATES

The following table lists the co-ordinates recorded for each census stop for the 2018 survey. The co-ordinate system used is UTM. The census stops are also shown on the following Map.

Census Stop	Corner Point	AMG zone	Easting	Northing
1	1	54J	0490013	6928493
	2	54J	0490513	6928495
	3	54J	0490513	6927995
	4	54J	0490012	6927995
	5	54J	0489513	6928493
	6	54J	0489513	6928993
	7	54J	0490013	6928993
2	1	54J	0484735	6920321
	2	54J	0485235	6920321
	3	54J	0485231	6919825
	4	54J	0484736	6919838
	5	54J	0484235	6920321
	6	54J	0484235	6920821
	7	54J	0484735	6920821
3	1	54J	0484141	6911271
	2	54J	0484640	6911275
	3	54J	0484639	6910774
	4	54J	0484138	6910771
	5	54J	0483641	6911273
	6	54J	0483641	6911773
	7	54J	0484141	6911773
4	1	54J	0490819	6905993
	2	54J	0491314	6905994
	3	54J	0491314	6905499
	4	54J	0490815	6905493
	5	54J	0490317	6905993
	6	54J	0490317	6906493
	7	54J	0490817	6906493
5	1	54J	0491798	6897070
	2	54J	0492302	6897067
	3	54J	0492302	6896562
	4	54J	0491801	6896568
	5	54J	0491298	6897070
	6	54J	0491298	6897570

Census Stop	Corner Point	AMG zone	Easting	Northing
	7	54J	0491798	6897570
6	1	54J	0491644	6887511
	2	54J	0492144	6887516
	3	54J	0492147	6887016
	4	54J	0491645	6887016
	5	54J	0491144	6887511
	6	54J	0491144	6888011
	7	54J	0491644	6888011
7	1	54J	0489094	6878102
	2	54J	0489597	6878101
	3	54J	0489591	6877604
	4	54J	0489091	6877604
	5	54J	0488593	6878102
	6	54J	0488593	6878602
	7	54J	0489093	6878602
8	1	54J	0489723	6871572
	2	54J	0490223	6871573
	3	54J	0490228	6871073
	4	54J	0489715	6871083
	5	54J	0489223	6871572
	6	54J	0489223	6872072
	7	54J	0489723	6872072
9	1	54J	0491530	6865270
	2	54J	0492033	6865271
	3	54J	0492036	6864774
	4	54J	0491527	6864778
	5	54J	0491034	6865272
	6	54J	0491034	6865772
	7	54J	0491534	6865772

B. MAP SHOWING CENSUS STOP LOCATIONS ALONG THE BORE TRACK NORTH



Source: VantagePoint™/DigitalGlobe™ overlaid with FOIR census stop co-ordinates

APPENDIX II - BIRD SURVEY DATA
Combined data for all 8 transects at each census stop

Date and time	Census Stop	Species	Seen/ Heard	Number	Co-ordinates
23/07/2018	CS1	Australian Raven	S	2	54 J
St. 15:00		Banded Lapwing	S	12	0490013E
Fin. 16:42		Black-faced Woodswallow	S	11	6928493N
		Corvid	S	2	
		Crested Pigeon	S	1	
		Galah	S	3	
		Little Crow	S	3	
		Singing Honeyeater	S	1	
		White-backed Swallow	S	1	
		Willie Wagtail	S	1	
		Zebra Finch	S/H	9	

24/07/2018	CS2	Black-faced Woodswallow	S	2	54J
St. 08:05		Chestnut-crowned Babbler	S	4	0484735E
Fin. 10:00		Chirruping Wedgebill	H	4	6920321N
		Corvid	H	1	
		Crested Pigeon	S	4	
		Galah	S	1	
		Little Crow	S	2	
		Singing Honeyeater	H	7	
		White-backed Swallow	S	3	
		White-winged Fairywren	H	8	
		White-winged Fairywren	H	1	
		Zebra finch	S	30	

24/07/2018	CS3	Australian Pipit	S	1	54J
St. 10:50		Black-faced Woodswallow	S	3	0484141E
Fin. 12:15		Brown Falcon	S	1	6911271N
		Corvid	S	1	
		Emu	S	17	
		Singing Honeyeater	S	1	
		Wedge-tailed Eagle	S	2	
		White-winged Fairywren	S	2	
		Willie Wagtail	S	1	

24/07/2018	CS4	Australian Pipit	S	1	54J
St. 15:20		Australian Raven	S	4	0490819E
Fin. 17:00		Black-faced Woodswallow	S	15	6905993N
		Chestnut-crowned Babbler	H	6	
		Chirruping Wedgebill	H	6	

		Cockatiel	S	2	
		Corvid	S	10	
		Crested Pigeon	H	5	
		Crested Pigeon	S	1	
		Crimson Chat	S	4	
		Little Crow	H	1	
		Singing Honeyeater	H	6	
		Singing Honeyeater	H	1	
		White-backed Swallow	S	4	
		White-winged Fairywren	H	3	
		Willie Wagtail	S	4	
		Zebra Finch	S	29	

25/07/2018	CS5	Australian Magpie	H	1	54J
St. 08:15		Black-faced Woodswallow	S	6	0491798E
Fin. 10:10		Brown Falcon	S	1	6897070N
		Brown Songlark	S	3	
		Chirruping Wedgebill	S	7	
		Chirruping Wedgebill	H	1	
		Crimson Chat	S	4	
		Orange Chat	S	5	
		Red-capped Robin	H	1	
		Singing Honeyeater	S	10	
		White-winged Fairywren	S	10	
		Willie Wagtail	S	2	
		Zebra Finch	S	20	

25/07/2018	CS6	Australian Pipit	S	2	54J
St. 11:05		Australian Raven	H	1	0491644E
Fin. 12:39		Black-faced Woodswallow	S	9	6887511N
		Bourkes Parrot	S	1	
		Brown Falcon	S	1	
		Chirruping Wedgebill	H	6	
		Crested Pigeon	H	2	
		Crimson Chat	S	11	
		Orange Chat	S	2	
		Red-capped Robin	S	1	
		Singing Honeyeater	H	6	
		Wedge-tailed Eagle	S	1	
		White-winged Fairywren	H	2	
		Willie Wagtail	S	2	
		Zebra Finch	S	4	







26/07/2018	CS7	Black-faced Woodswallow	S	12	54J
St. 10:40		Chirruping Wedgebill	H	1	0489094E






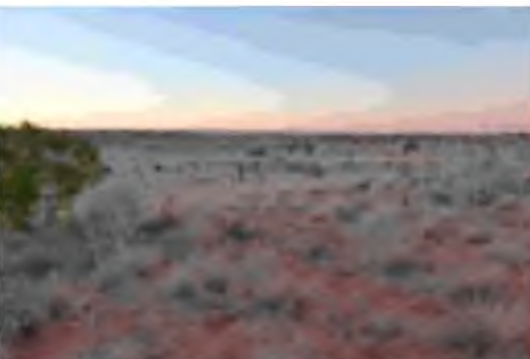

Fin. 12:25		Crested Pigeon	H	1	6878102N
		Crimson Chat	S	3	
		Nankeen Kestrel	S	1	
		Orange Chat	S	2	
		Singing Honeyeater	S	5	
		White-winged Fairywren	H	3	
		Zebra Finch	S	70	







26/07/2018	CS8	Australian Pipit	S	1	54J
St. 08:00		Black-faced Woodswallow	S	7	0489723E
Fin. 09:55		Chirruping Wedgebill	H	2	6871572N
		Crested Pigeon	S	2	
		Crimson Chat	S	18	
		Orange Chat	S	13	
		Singing Honeyeater	H	5	
		White-backed Swallow	S	2	
		White-winged Fairywren	H	12	
		Willie Wagtail	S	1	





25/07/2018	CS9	Brown Falcon	S	1	54J
St. 15:45		Crested Pigeon	S	3	0491530E
Fin. 17:20		Nankeen Kestrel	S	1	6865270N
		Singing Honeyeater	H	1	
		White-winged Fairywren	S	11	









APPENDIX III – CORNER POINT PHOTOS: 2013 vs 2018









Census stop 1	2013	2018
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)	Nil photo	
Left (away from eastern quadrant)	Nil photo	









Census stop 1	2013	2018
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)	Nil photo	
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		





Census stop 1	2013	2018
Corner point 5		
Right (to centre of western quadrant)	Nil photo	
Left (away from western quadrant)	Nil photo	
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		









Census stop 1	2013	2018
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		









Census stop 2	2013	2018
Corner point 1		
Right (to centre of eastern quadrant)	 A photograph showing a person standing in a field of low, dry vegetation under a blue sky with scattered clouds. The terrain is reddish-brown.	 A photograph showing a field of low, dry vegetation under a clear blue sky. The terrain is reddish-brown.
Left (to centre of western quadrant)	 A photograph showing a field of low, dry vegetation under a clear blue sky. The terrain is reddish-brown.	 A photograph showing a field of low, dry vegetation under a clear blue sky. The terrain is reddish-brown.
Corner point 2		
Right (to centre of eastern quadrant)	 A photograph showing a field of low, dry vegetation under a clear blue sky. The terrain is reddish-brown.	 A photograph showing a field of low, dry vegetation under a clear blue sky. The terrain is reddish-brown.
Left (away from eastern quadrant)	 A photograph showing a field of low, dry vegetation under a clear blue sky. The terrain is reddish-brown.	 A photograph showing a field of low, dry vegetation under a clear blue sky. The terrain is reddish-brown.









Census stop 2	2013	2018
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		





Census stop 2	2013	2018
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		









Census stop 2	2013	2018
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 3	2013	2018
Corner point 1		
Right (to centre of eastern quadrant)	 A photograph of a flat, arid landscape with reddish-brown soil and sparse, low-lying vegetation. A yellow flag is planted in the ground in the foreground. A blue vehicle is visible in the distance on the left.	 A photograph of the same location in 2018. The vegetation appears slightly more green and dense than in 2013. The yellow flag and the blue vehicle in the distance are still visible.
Left (to centre of western quadrant)	 A photograph of a flat, arid landscape with reddish-brown soil and sparse, low-lying vegetation. The horizon is visible under a clear blue sky.	 A photograph of the same location in 2018. The vegetation appears slightly more green and dense than in 2013. The horizon is visible under a clear blue sky.
Corner point 2		
Right (to centre of eastern quadrant)	 A photograph of a flat, arid landscape with reddish-brown soil and sparse, low-lying vegetation. The horizon is visible under a clear blue sky.	 A photograph of the same location in 2018. The vegetation appears slightly more green and dense than in 2013. The horizon is visible under a clear blue sky.
Left (away from eastern quadrant)	 A photograph of a flat, arid landscape with reddish-brown soil and sparse, low-lying vegetation. The horizon is visible under a clear blue sky.	 A photograph of the same location in 2018. The vegetation appears slightly more green and dense than in 2013. The horizon is visible under a clear blue sky.









Census stop 3	2013	2018
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		



Census stop 3	2013	2018
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		









Census stop 3	2013	2018
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		









Census stop 4	2013	2018
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		









Census stop 4	2013	2018
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		





Census stop 4	2013	2018
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		









Census stop 4	2013	2018
Corner point 7		
Right (to centre of western quadrant)	Nil photo	
Left (away from western quadrant)	Nil photo	









Census stop 5	2013	2018
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		









Census stop 5	2013	2018
Corner point 3		
Right (to centre of eastern quadrant)	 A photograph showing a landscape with dark, rocky ground in the foreground and sparse vegetation in the distance under a clear blue sky.	 A photograph showing a landscape with reddish-brown soil and sparse vegetation under a cloudy sky.
Left (away from eastern quadrant)	 A photograph showing a landscape with dark, rocky ground in the foreground and sparse vegetation in the distance under a clear blue sky.	 A photograph showing a landscape with reddish-brown soil and sparse vegetation under a cloudy sky.
Corner point 4		
Right (to centre of eastern quadrant)	 A photograph showing a landscape with dark, rocky ground in the foreground and sparse vegetation in the distance under a clear blue sky.	 A photograph showing a landscape with reddish-brown soil and sparse vegetation under a cloudy sky.
Left (away from eastern quadrant)	 A photograph showing a landscape with dark, rocky ground in the foreground and sparse vegetation in the distance under a clear blue sky.	 A photograph showing a landscape with reddish-brown soil and sparse vegetation under a cloudy sky.





Census stop 5	2013	2018
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		









Census stop 5	2013	2018
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		









Census stop 6	2013	2018
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		









Census stop 6	2013	2018
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		





Census stop 6	2013	2018
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		





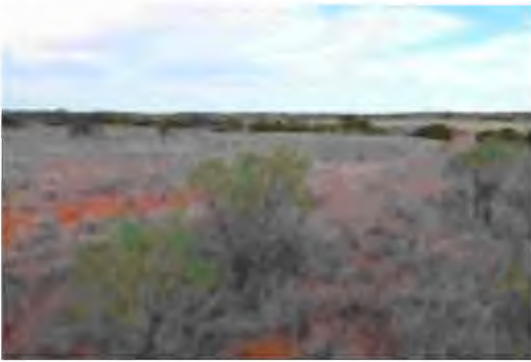



Census stop 6	2013	2018
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		









Census stop 7	2013	2018
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		





Census stop 7	2013	2018
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		





Census stop 7	2013	2018
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		






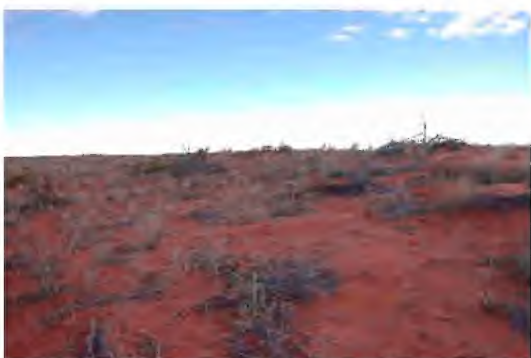

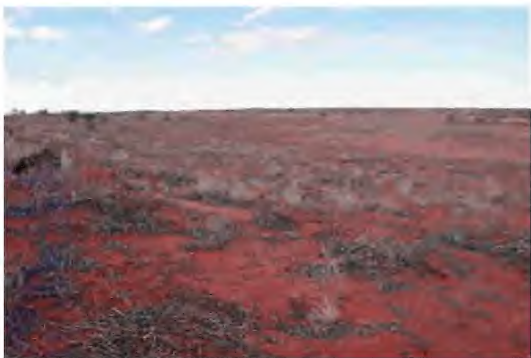
Census stop 7	2013	2018
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		









Census stop 8	2013	2018
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		


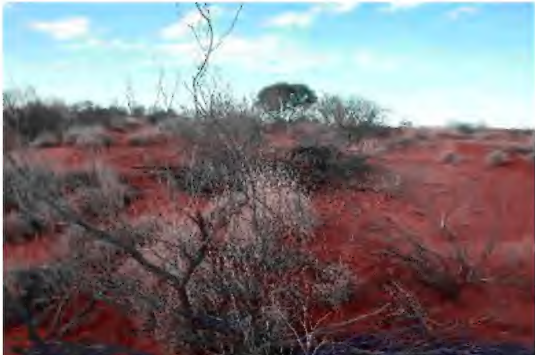






Census stop 8	2013	2018
Corner point 3		
Right (to centre of eastern quadrant)	 A photograph showing a landscape with sparse, low-lying green and grey shrubs on a reddish-brown soil under a blue sky with scattered white clouds.	 A photograph showing a landscape with sparse, low-lying green and grey shrubs on a reddish-brown soil under a clear blue sky.
Left (away from eastern quadrant)	 A photograph showing a landscape with sparse, low-lying green and grey shrubs on a reddish-brown soil under a blue sky with scattered white clouds.	 A photograph showing a landscape with sparse, low-lying green and grey shrubs on a reddish-brown soil under a clear blue sky.
Corner point 4		
Right (to centre of eastern quadrant)	 A photograph showing a landscape with sparse, low-lying green and grey shrubs on a reddish-brown soil under a blue sky with scattered white clouds.	 A photograph showing a landscape with sparse, low-lying green and grey shrubs on a reddish-brown soil under a clear blue sky.
Left (away from eastern quadrant)	 A photograph showing a landscape with sparse, low-lying green and grey shrubs on a reddish-brown soil under a blue sky with scattered white clouds.	 A photograph showing a landscape with sparse, low-lying green and grey shrubs on a reddish-brown soil under a clear blue sky.





Census stop 8	2013	2018
Corner point 5		
Right (to centre of western quadrant)	 A wide-angle photograph of a dry, open landscape with sparse, low-lying vegetation under a cloudy sky.	 A wide-angle photograph of a dry, open landscape with sparse, low-lying vegetation under a clear blue sky.
Left (away from western quadrant)	 A wide-angle photograph of a dry, open landscape with sparse, low-lying vegetation under a clear blue sky.	 A wide-angle photograph of a dry, open landscape with sparse, low-lying vegetation under a clear blue sky. The shadows of the photographer and a companion are visible in the foreground.
Corner point 6		
Right (to centre of western quadrant)	 A wide-angle photograph of a dry, open landscape with sparse, low-lying vegetation under a cloudy sky.	 A wide-angle photograph of a dry, open landscape with sparse, low-lying vegetation under a clear blue sky.
Left (away from western quadrant)	 A wide-angle photograph of a dry, open landscape with sparse, low-lying vegetation under a cloudy sky.	 A wide-angle photograph of a dry, open landscape with sparse, low-lying vegetation under a clear blue sky.

Census stop 8	2013	2018
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 9	2013	2018
Corner point 1		
Right (to centre of eastern quadrant)	 A photograph taken in 2013 showing a landscape with tall, dry grass and scattered shrubs. A blue car is visible in the distance under a clear blue sky.	 A photograph taken in 2018 showing a landscape with low-lying shrubs and a red soil surface. A blue car is visible in the distance under a blue sky with some clouds.
Left (to centre of western quadrant)	 A photograph taken in 2013 showing a landscape with low-lying shrubs and a red soil surface. A blue car is visible in the distance under a clear blue sky.	 A photograph taken in 2018 showing a landscape with low-lying shrubs and a red soil surface. A blue car is visible in the distance under a blue sky with some clouds.
Corner point 2		
Right (to centre of eastern quadrant)	 A photograph taken in 2013 showing a landscape with low-lying shrubs and a red soil surface. A blue car is visible in the distance under a clear blue sky.	 A photograph taken in 2018 showing a landscape with low-lying shrubs and a red soil surface. A blue car is visible in the distance under a blue sky with some clouds.
Left (away from eastern quadrant)	 A photograph taken in 2013 showing a landscape with low-lying shrubs and a red soil surface. A blue car is visible in the distance under a clear blue sky.	 A photograph taken in 2018 showing a landscape with low-lying shrubs and a red soil surface. A blue car is visible in the distance under a blue sky with some clouds.

Census stop 9	2013	2018
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 9	2013	2018
Corner point 5		
Right (to centre of western quadrant)	 A photograph showing a landscape with tall, dry, yellowish-brown grass in the foreground and several green shrubs in the background under a clear blue sky.	 A photograph showing a landscape with sparse, low-lying shrubs on a red soil surface under a blue sky with some clouds.
Left (away from western quadrant)	 A photograph showing a landscape with dry grass and a large, leafy tree in the background under a clear blue sky.	 A photograph showing a landscape with sparse, low-lying shrubs on a red soil surface under a blue sky with some clouds.
Corner point 6		
Right (to centre of western quadrant)	 A photograph showing a landscape with dry grass and a large, leafy tree in the background under a clear blue sky. A person's shadow is visible in the foreground.	 A photograph showing a landscape with sparse, low-lying shrubs on a red soil surface under a clear blue sky. Two people's shadows are visible in the foreground.
Left (away from western quadrant)	 A photograph showing a landscape with dry grass and several small trees in the background under a clear blue sky.	 A photograph showing a landscape with sparse, low-lying shrubs on a red soil surface under a bright sun with lens flare.

Census stop 9	2013	2018
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		










APPENDIX IV – TRANSECT PHOTOS














Original photographs are available from FOIR for analysis if required.











Census stop 1 Date: 23/7/18 Commenced: 15:00













Weather: Warm, moderate NW wind, 10% cloud









Number of observers: 6

Transect A	Sand plain/dune with low grasses and forbs. 30% vegetation cover. Some herbs after rain. Scattered Whitewood and Needlewood, heavily grazed.	
		
Cattle tracks and pipeline	Dam and water pipeline	Mole cricket mound
		
Dead Saltbush on clay pan	Rabbit warren	Small mammal hole
		
Small mammal tracks	Ephemerals in swale	Trees and green flush in swale approaching dune













Transect B	Dune with Canegrass, open Whitewood woodland. 50% vegetation cover, 10% dead plants	
		
Canegrass on dune crest	Mole cricket mound	Rabbit warren, Whitewood, new growth on dune
		
Saltbush new growth in swale	Needlewood and bloodwood	Dune slope with <i>Triodia</i> and shrubs
Transect C	Interdune. 20% vegetation cover. Open Whitewood and Needlewood. Ephemeral plants starting to grow.	
		
Dingo tracks	Deep cattle pad in swale	Drought affected dune plants
		
Emu footprint	Hopping bird, Zebra Finch?	<i>Hakea leucoptera</i>
		
<i>Eremophila</i> and view across swale to dune		













Transect D	Dune slope. 30% vegetation cover. Needlewood with <i>Triodia</i> understory. Occasional Whitewood, Acacia.	
		
Dingo tracks with direct registration	<i>Hakea leucoptera</i>	Sparse shrubs and ground cover. Deep cattle tracks
		
Hopping bird tracks		
Transect E	Dunes and swales. Emergent herbs. Canegrass, sand blow-outs. Mulga. Sand plain. <i>Acacia ligulata</i>	
		
Sand blow-out and erosion channel	Stone flakes	Cattle tracks across dune into swale
		
View from dune top – dingo at puddle near tank	Whitewoods across western face of dune	Deep cattle trail across swale















Transect F	Broad swale. 20% vegetation cover. Occasional Coolibah, <i>Acacia ligulata</i> . Emergent herbage.	
		
Reptile burrow beneath Acacia	Water pipe and cattle pad	Cattle tracks
		
<i>Acacia victoriae</i>	Canegrass on dune crest	Canegrass and shrubs on lower dune
		
Reptile burrow	Mole cricket mound	<i>Sclerolaena sp.</i>
Transect G	Dunes close to cattle yards and water point. Vegetation and soil surface highly degraded from over-grazing.	
		
Stallion dung pile	<i>Owenia acidula</i>	<i>Owenia acidula</i>















		
Isolated tussocks with ephemeral herbs	Stockyard and waterhole	Water channel
		
Dead cow	Undulating sand plain with sparse <i>Acacia victoriae</i>	
Transect H	Very sparsely covered sand plain. 20% vegetation cover. Emergent forbs on the dune rise to east. Whitewood, <i>Hakea leucoptera</i> , <i>Owenia acidula</i> .	
		
<i>Sclerolaena bicornis</i>	<i>Owenia acidula</i> and Whitewood on dune	Sand plain and tank

Census stop 2 Date: 24/7/18 Commenced: 08:05
Weather: Fine, cool/mild. Calm. 10% cloud cover
Number of observers: 6

Transect A		Open Needlewood with saltbush sand plain
		
Small mammal hole under <i>Triodia</i>	Cat tracks?	Stone flakes on washout
		
Stone flake	Cattle pad	<i>Triodia</i>
		
Small snake track	Babblers nest in Whitewood	Gully erosion
Transect B		<i>Triodia</i> grassland. 40% vegetation cover. Scattered Dodonaea, Whitewood. Lone Bloodwood.
		
Triodia grassland with scattered shrubs	Small rodent or dunnart tracks	Dragon tracks?

		
View over dune to swale – <i>Triodia</i> grassland	Scorpion tracks and hole	Dune slopes – Whitewood, <i>Triodia</i> and succulents
Transect C	East facing dune. Canegrass on crest. Whitewood and <i>Triodia</i> .	
		
Whitewood, <i>Triodia</i> and Canegrass on dune	Old rabbit warren	<i>Crotalaria eremaea</i>
		
View along transect	<i>Eremophila longifolia</i>	<i>Acacia tetragonophylla</i>
Transect D	Sand plain, scattered Needlewood. Ephemeral ground cover.	
		
Open acacia shrubland	Sand plain with sparse tussock	Creek erosion with cattle tracks

Transect E	Dunes and swales. 30% vegetation cover. Sparse cover of <i>Hakea leucoptera</i> , <i>Acacia ligulata</i> and scattered spinifex higher up dune. Sparse covering of forbs on understory.		
			
Stand of Whitewood	<i>Eremophila longifolia</i>	Deep erosion channels	
			
Cattle tracks are a focus for erosion	Washout at base of dune with Whitewood stand	Hop bush, <i>Dodonea viscosa</i>	
			
Whitewood stand and <i>Triodia</i> grassland	Reptile burrow		
Transect F	Dune face (east). 50% vegetation cover. Canegrass on crest. <i>Grevillia stenobotrya</i> . Spinifex. Occasional Acacia.		
			
Crested Pigeon tracks?	Small rodent or dunnart tracks	Cattle tracks on mobile dune	
			
Old rabbit warren	Cat tracks?	Dune crest with <i>Crotalaria</i> and hop bush	

Transect G		Dune swale. 20% vegetation cover. Spinifex. Scattered Acacia and hop bush.	
			
Scorpion burrow	Beetle tracks	Crotalaria eremaea	
			
Dune crest with shrubs, Canegrass and Triodia	Nest in whitewood	Fresh rabbit scats	
			
Triodia circle – long unburnt	Dune and swale	Ant nest	
Transect H		Dunes and swales. 30% vegetation cover. Spinifex 5%. Whitewood 5%. Emergent forbs/herbs. Occasional Acacia and Hop Bush.	
			
Erosion gully on dune slope.	Sclerolaena sp.	Dead saltbush on clay pan	
			
Dead Dissocarpus	Bore Track		










Census stop 3














Date: 24/7/18



Commenced: 10:50

Weather: Fine, mild. 0% cloud















Number of observers: 6















Transect A	Undulating gibber plain with wet areas. Patchy vegetation cover 20-40%. Ephemeral forbs. Occasional bushes - Needlewood	
		
Regenerating saltbushes	Gully erosion on gibber plain	Emus and cattle
Transect B	Gibber plain with ephemeral forbs and low saltbush.	
		
Dead cow	<i>Hakea leucoptera</i>	Water course across gibber plain
Transect C	Gibber plain with ephemeral water course. 10% vegetation cover. Ephemeral forbs starting to appear.	
		
<i>Calotis plumulifera</i>		
Transect D	Gibber plain, low saltbush, watercourse to west.	
		
Regenerating herbs	<i>Euphorbia stevenii</i>	












Transect E	Undulating sand plain, gibber rise with emergent forbs variable density. Low bushes on crests and creek lines.	
		
Cattle pad	Whitewood and Acacia on edge of gibber plain	Stone flakes exposed by sand blow-out.
Transect F	Gibber flat to low rise with occasional Acacia at crest, Whitewood below crest. Emergent forbs, Sclerolaena.	
		
Low rise with Acacia	Sand plain with distant creek-line	<i>Sclerolaena divaricata</i>
Transect G	Slow rise sand plain with occasional Whitewood, <i>Acacia</i> , <i>Hakea</i> , <i>Sclerolaena (bicornis-lanicuspis)</i> . 15% veg. cover.	
		
<i>Acacia ligulata</i>	<i>Acacia ligulata</i>	Recovering <i>Sclerolena</i> spp.
		
<i>Acacia oswaldii</i>	Sandy rise with Acacia and dead <i>Crotalaria</i>	Zebra Finch nest in Whitewood
		
Sand blow exposing stone flakes		












Transect H	Sand plain. 15% vegetation cover. Some emergent herbs. Dead finish, some Acacia, Whitewood higher up on crest of rise.	
		
<i>Podaxis pistillaris</i>	Sand plain/gibber plain	

Census stop 4 Date: 24/7/18 Commenced: 15:20
Weather: Warm-hot, light breeze. 0% cloud
Number of observers: 6


Transect A	Open shrubland, Senna, Acacia. 20% vegetation cover. Sand plain. Creek line to west 10m.	
		
<i>Triodia</i> recovering after 2012 fires	Rodent tracks	Active rabbit warren
		
<i>Sclerolaena</i> sp.	<i>Crotalaria eremaea</i>	<i>Owenia acidula</i> on sand ridge
		
Small mammal tracks	<i>Owenia acidula</i>	<i>Owenia acidula</i>
		
<i>Ptilotus polystachyus</i>	Sandplain with scattered shrubs	<i>Polycalymma stuartii</i>
		
<i>Crotalaria cunninghamii</i>	<i>Portulaca oleracea</i>	














Transect B	Dune slope. Open shrubs – many dead, saltbush, <i>Crotalaria</i> and ephemerals regenerating.	
		
Limited <i>Triodia</i> recovery after 2012 fires	Dingo tracks	Cattle pad. Area heavily grazed
		
Ant nest with discarded seed husks	<i>Acacia ligulata</i>	<i>Acacia ligulata</i>
Transect C	Dune crest. 20% vegetation cover. Canegrass and scattered saltbush.	
		
<i>Polycalymma stuartii</i>	Small mammal tracks	<i>Ptilotus polystachyus</i>
		
Burnt shrubs from 2012 fires	Acacia regeneration	Dune slope with scattered shrubs
		
Cattle pad	Emu and Dingo tracks	















Transect D		
		
<i>Trichodesma zeylanicum</i>	<i>Portulacca oleracea</i>	Lizard burrow
Transect E	Dunes and swales, sparse understorey of <i>Sclerolaena</i> , occasional wattle (<i>ligulata</i>)	
		
Whitewood with <i>Sclerolaena</i> understorey	<i>Crotolaria eremaea</i>	<i>Grevillea stenobotrya</i>
		
<i>Abutilon</i> sp.	Whitewood woodland	
Transect F	Swales and dunes. 30% vegetation cover. <i>Acacia</i> and Whitewood, occasional <i>Triodia</i> , understorey woolly <i>Sclerolaena</i> .	
		
<i>Santalum lanceolatum</i>	Sand plain with <i>Acacia anuera</i>	<i>Acacia ligulata</i> on rise













Transect G	Stony rise with understorey of dead forbs and emerging <i>Sclerolaena</i> . <i>Acacia ligulata</i> on higher rises. 20% vegetation cover.	
		
Dune crest and swale	Stony plain	Stony plain
Transect H	Stony flat swale with 40% ground cover of forbs. Red dunes at southern edge with <i>Acacia</i> and <i>Whitewood</i> .	
		
Cracking mud on clay pan	Clay pan and dune	Whitewood on dune
		
Dune Canegrass	Dune with <i>Owenia</i> on slopes	Hopping bird. Zebra Finch?
		
Small mammal tracks	<i>Salsola tragus</i>	















Census stop 5 Date: 25/7/18 Commenced: 08:15
Weather: Mild, light SW breeze, 20% cloud
Number of observers: 6











Transect A	Sand plain with Saltbush. Scattered Acadia, Whitewood on slopes. 50% vegetation cover.	
		
<i>Eragrostis australasica</i>	<i>Eragrostis australasica</i>	<i>Chenopodium auricomum</i>
		
<i>Rhodanthe corymbiflora</i>	<i>Senecio gregorii</i>	<i>Atriplex vesicaria</i>
		
<i>Ptilotus polystachyus</i>	<i>Eragrostis australasica</i>	Whitewood
		
Old growth <i>Triodia</i>	<i>Calandrinia</i> sp.	<i>Atriplex nummularia</i>
		
Sand plain with <i>Triodia</i>	<i>Polycalymma stuartii</i>	

Transect B	Dune slope with long unburnt <i>Triodia</i> and scattered Acacia. Regenerating ephemeral herbs.	
		
Old growth <i>Triodia</i>	<i>Euphorbia stevenii</i>	Ephemeral wetland/clay pan
		
<i>Erodium crinitum</i>	<i>Rhodanthe corymbiflora</i>	Ants
		
Gully erosion on dune slope		
Transect C	Sand plain with scattered saltbush, Whitewood and Acacia on dune slope. 40% vegetation cover.	
		
<i>Enchylaena tomentosa</i>	Trees on dune slope	<i>Trichodesma zeylanicum</i>
		
Acacia on dune slope	<i>Grevillea stenobotrya</i>	<i>Grevillea stenobotrya</i>
















		
Whitewood stand	Sedge	Old Whitewood
		
<i>Crotalaria eremaea</i>	Small mammal tracks	<i>Ptilotus polystachyus</i>
		
<i>Polycalymma stuartii</i>	Sand plain with <i>Triodia</i> and shrubs	
Transect D	Sand plain with saltbush and scattered shrubs. 40% vegetation cover.	
		
Eroded clay pan	<i>Astrebla</i> sp. and shrubs along drainage line	<i>Astrebla</i> sp.
		
Seedling growth in gilgai	<i>Maireana</i> sp.	<i>Maireana</i> sp.










		
<i>Podaxis pistillaris</i>		
Transect E	Undulating sand plain, low red sand dunes, isolated stands of Whitewood, <i>Hakea leucoptera</i> , <i>Acacia ligulata</i> , sparse understorey of <i>Sclerolaena</i> . 40% vegetation cover.	
		
Acacia and Hakea around ephemeral wetland	<i>Hakea leucoptera</i>	Saltbush
		
<i>Astrebla</i> sp. on sand plain	<i>Astrebla</i> sp.	
Transect F	Dune face (east). 40% vegetation cover. Scattered Acacia, Whitewood, with <i>Triodia</i> understorey.	
		
Ant nest	<i>Triodia</i> and shrubs near ephemeral wetland	<i>Goodenia</i> sp.
		
Mulga, <i>Acacia aneura</i>	<i>Ptilotus</i>	Mole cricket burrow castings













		
<i>Atriplex nummularia</i> and <i>Enchylaena tomentosa</i>	<i>Dissocarpus paradoxus</i>	<i>Senecio gregorii</i>
Transect G	Dune/swale. 20% vegetation cover. <i>Triodia</i> understorey. Scattered <i>Acacia ligulata</i> and Hop Bush.	
		
Reptile burrow	Termite mound	Mature <i>Triodia</i>
		
Clay pan with line of driftage	Saltbushes on claypan	
Transect H	Undulating low dunes and clay pan/flat swales. Scattered Acacias and Whitewood.	
		
<i>Crotalaria eremaea</i>	<i>Polycalymma stuartii</i>	<i>Crotalaria eremaea</i>
		
<i>Ptilotus polystachyus</i>	<i>Indigofera brevidens</i>	<i>Grevillea stenobotrya</i>

		
<i>Grevillea stenobotrya</i>	<i>Salsola australis</i>	<i>Abutilon sp.</i>
		
Nest, Singing Honeyeater?	<i>Rhodanthe floribunda</i>	Dingo tracks
		
<i>Atriplex nummularia</i>	<i>Eragrostis australasica</i>	<i>Eragrostis australasica</i>
		
<i>Atriplex vesicaria</i>		













Census stop 6 Date: 25/7/18 Commenced: 11:05
Weather: Warm. SE wind. 60% cloud
Number of observers: 6


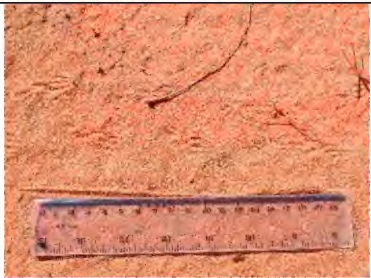












Transect A	Sand plain. Sparse saltbush. 10% vegetation cover.	
		
Dune and borrow pit	<i>Acacia ligulata</i>	<i>Acacia ligulata</i>
		
Dune erosion	<i>Hakea leucoptera</i>	<i>Hakea leucoptera</i>
Transect B	Sand plain with erosion scars. Scrub dominated by Needlewood. 10% vegetation cover.	
		
Dingo tracks	<i>Eremophila duttonii</i> and <i>Hakea leucoptera</i>	<i>Eremophila duttonii</i>
		
Termite mound	Buried gas line	Raven nest in whitewood
		
Bourke's Parrot nest	Bourke's Parrot nest tree	Whitewood on dune with <i>Triodia</i> understory












Transect C	Dune slope. <i>Triodia</i> with scattered Whitewood.	
		
Castings	Shallow watercourse	
Transect D	Sand plain. Many ephemeral herbs. 40% ground cover.	
		
Sandplain showing disturbance from old track		
Transect E	Clay over sand plain. Surrounded by low dune with scattered covering of Whitewood, <i>Hakea leucoptera</i> , <i>Acacia ligulata</i> . 15% vegetation cover.	
		
<i>Lysiana exocarpi</i> with Zebra Finch nest	Sand plain with emergent saltbush and mulga beyond	Scarab beetle
Transect F	Undulating sand plain. <i>Triodia</i> , <i>Hakea</i> on low rise and <i>Sclerolaena</i> on plain. 30-40% vegetation cover.	
		
<i>Triodia</i> recovery after 2012 fires	<i>Eragrostis eriopoda</i>	<i>Crotalaria cunninghamii</i>














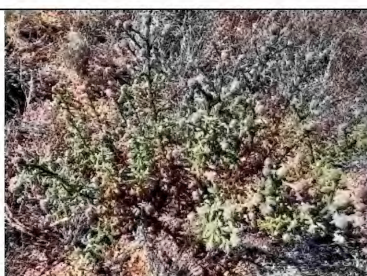
		
Dune swale with ephemeral wetland	<i>Duma florulenta</i>	Nest in <i>Hakea leucoptera</i>
		
<i>Eremophila bignoniflora</i>		
Transect G	Undulating sand plain. <i>Triodia</i> ground cover. Scattered Hakea, occasional <i>Eremophila longifolia</i> and Whitewood. 20% vegetation cover.	
		
Clay pan with gilgai	Dingo scat	Dragon Tracks
		
Lizard burrow	Sand plain	
Transect H	Undulating sand plain. 15% vegetation cover. Sparse Sclerolaena and emergent forbs. Scattered Hakea and Whitewood (conc. on rises).	
		
Gas line and coms tower	Clay pan	Bore Track

Census stop 7 Date: 26/7/18 Commenced: 10:40
 Weather: Mild, moderate-strong NE wind
 Number of observers: 6














Transect A	Sand plain, sparse ephemerals, <i>Triodia</i> on dune crest. 15% vegetation cover.	
		
Shrubs on dune slope	Scat, Cat or small Dingo?	Clay pan
		
<i>Hakea leucoptera</i>	Seedlings after rain	<i>Triodia</i> and Acacia recovery after 2012 fires
		
Mature <i>Triodia</i> hummock	Test site cap	Test site (gas pipeline?)
Transect B	Sand plain between dunes. Scattered Eremophila, tussocks, ephemeral herbs. 10% vegetation cover.	
		
Germinating ephemeral herbs	<i>Senecio gregorii</i> and other ephemerals	Dune slope still recovering after 2012 fires






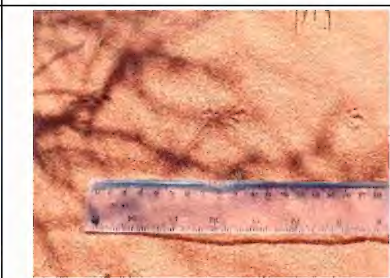








		
Dune slope with dead shrubs	Dragon tracks	Kangaroo tracks on clay pan
		
<i>Podaxis pistillaris</i>	Water channel across sand plain	Cattle scats
		
Horse or Donkey scats	Regenerating <i>Triodia</i>	
Transect C	Dune slope/sand plain. Sparse <i>Triodia</i> and <i>Eremophila</i> . Few ephemerals. 10% vegetation cover.	
		
Scat, Cat or small Dingo?	Horse or Donkey scats	<i>Solanum coactiliferum</i>
		
<i>Solanum coactiliferum</i>	Whitewood trees on dune slope	Corvid nest














		
Corvid tracks	<i>Blennodia canescens</i>	
Transect D	Sand plain with sparse tussock and occasional <i>Triodia</i> and shrubs. 10% vegetation cover.	
		
Sand plain		
Transect E	Low dune and swale. 15% vegetation cover. Occasional <i>Triodia</i> and low <i>Acacia ligulata</i> , <i>Hakea leucoptera</i> , Whitewood.	
		
Clay pan with <i>Duma florulenta</i>	Dingo tracks	Babbler's nest
		
Stone flake	Dingo scats	Corvid nest in dead tree
Transect F	Low dunes and swales. 20% vegetation cover. <i>Triodia</i> . Overstorey scattered <i>Acacia ligulata</i> and some Whitewood on crest.	
		
Dead shrubs on dune slope	Swale with <i>Astrebla</i> , <i>Triodia</i> on the dunes	

Transect G	Low dunes and shallow swales. 25% vegetation cover. <i>Acacia ligulata</i> scattered across swale and dune face. Whitewood on crest. Occasional <i>Hakea leucoptera</i> and <i>Eremophila longifolia</i> .		
			
<i>Triodia</i> grassland	<i>Corymbia terminalis</i>	<i>Corymbia terminalis</i>	
			
<i>Acacia victoriae</i>	<i>Lysiana exocarpi</i>	Zebra Finch nest in <i>Acacia victoriae</i>	
			
Borrow pit	<i>Salsola australis</i>		
Transect H	Large swale. 30% vegetation cover. Surrounded by dune. Dominated by <i>Acacia ligulata</i> , <i>Acacia aneura</i> , <i>Hakea leucoptera</i> on dune rise.		
			
Horse/donkey scats	Clay pan with dead saltbush	Fox scat	
			
Bird's egg – Australasian pipit?	Vehicle tracks to clay pan	<i>Pterocaulon sphacelatum</i>	





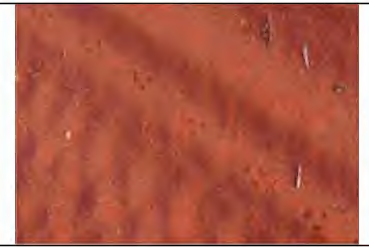





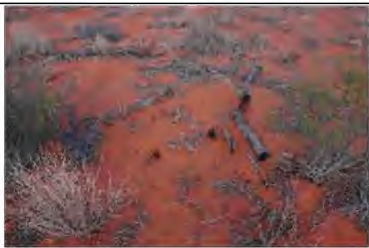


Census stop 8 Date: 26/7/18 Commenced: 08:00
Weather: Fine, light southerly breeze, sunny
Number of observers: 6













Transect A	Dune slope, Whitewood, Mulga, regenerating <i>Triodia</i>	
		
<i>Melaleuca interioris</i>	<i>Melaleuca interioris</i>	<i>Atriplex nummularia</i> on clay pan
		
Ephemeral herbs germinating in a gilgai	<i>Melaleuca interioris</i>	Water channels on sand plain
Transect B	Dune slope with Eremophila, Mulga, Needlewood. <i>Melaleuca</i> on lower slopes. 30% vegetation cover.	
		
Mole cricket castings	<i>Calandrinia</i> sp.	Old vehicle track
		
<i>Melaleuca interioris</i>	<i>Triodia</i> and shrubs on dune	Dragon tracks
		
Ants nest		















Transect C	Dune slope with scattered <i>Dodonea</i> , <i>Grevillia</i> . 20% vegetation cover	
		
Dune slope with <i>Triodia</i> and <i>Grevillea</i>	Old vehicle track	<i>Melaleuca interioris</i>
		
<i>Sclerolaena bicornis</i>	<i>Duma florulenta</i> on ephemeral wetland	Corvid tracks
Transect D	Sand plain with low saltbushes. 20% vegetation cover.	
		
Grindstone	Sand plain, low saltbushes	Shrubs on sand plain
Transect E	Low jumbled dunes. 30% vegetation cover. Dead forbs and Hop Bush. Scattered <i>Triodia</i> , denser on higher slopes. Occasional Mulga on crest. <i>Eremophila longifolia</i> .	
		
Lizard, mammal tracks	<i>Triodia</i> on dune slope	<i>Calandrinia</i> sp.
		
Lizard tracks	Emu tracks	

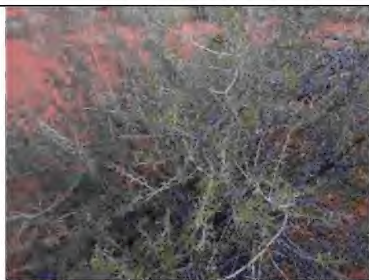










Transect F	10% vegetation cover in claypan, dune. Low shrubs over scattered <i>Triodia</i> . Occasional Mulga and <i>Hakea leuoptera</i> .	
		
<i>Erodium</i> seedlings	Scorpion burrow	Zebra Finch nest in Acacia
		
Small mammal tracks		
Transect G	Low dunes and swales. 30% vegetation cover. Hop bush and occasional <i>Acacia ligulata</i> over <i>Triodia</i> .	
		
Shrubs and <i>Triodia</i> on dune slope	Ephemeral wetland with <i>Duma florulenta</i>	<i>Eremophila maculata</i>
Transect H	Swale alongside road. <i>Sclerolaena</i> and occasional tussock grass, <i>Acacia</i> , <i>Hakea leuoptera</i> . 20% vegetation cover.	
		
Old survey marker (HO8xx 91-CZF KP264))	Shrubs on lower dune	<i>Solanum coactiliferum</i>
		
Stone flake	Small mammal tracks	Burnt stump, 2012 fires

Census stop 9 Date: 25/7/18 Commenced: 15:45
Weather: Warm, southerly breeze. 30% cloud
Number of observers: 6

Transect A	Sand plain between dunes, scattered Acacia and <i>Triodia</i> . 15% vegetation cover. Most ephemeral shrubs dead.	
		
Dragon tracks	Dune crest	Water erosion, <i>Triodia</i> on dune slope
		
Small mammal tracks on road	Small mammal tracks on road	<i>Eremophila maculata</i>
		
Sand plain with sparse vegetation	<i>Podaxis pistillaris</i>	Horse/donkey scats
		
<i>Solanum coactiliferum</i>	Burnt trees from 2012 fires	Rabbit warren
		
Dead trees on dune crest		

Transect B	Dune - sparse grasses including <i>Triodia</i> . Most shrubs and ephemerals dead. 10% vegetation cover.	
		
Vehicle tracks	<i>Senna sp.</i>	<i>Astrebla sp.</i>
		
Sand plain with tussock grassland	Bore Track	
		
Sand plain with old shot line?		Old survey marker (89CDT VP313)
Transect C	Clay pan with dead saltbushes. Crab holes and gilgai.	
		
Bird tracks	<i>Triodia</i> grassland	<i>Eremophila longifolia</i> on dune crest
		
<i>Triodia</i> flowering	Healthy <i>Triodia</i> grassland on dune	

Transect D	Dune crest with <i>Triodia</i> , <i>Grevillia</i> , <i>Dodonea</i> . Few wattles. 30% vegetation cover.	
		
<i>Triodia</i> on dune	<i>Grevillea stenobotrya</i>	Hopping bird tracks
		
<i>Grevillea stenobotrya</i>	Small mammal tracks	Dune crest
		
Small mammal tracks	Dragon tracks	
Transect E	Dunes and swales. 20% vegetation cover. <i>Spinifex</i> , <i>Acacia ligulata</i> , <i>Grevillia stenobotrya</i> , Hop Bush, patch of <i>Eremophila longifolia</i> , dead <i>Crotalaria eremaea</i> .	
		
Sand plain recovering after 2012 fires	<i>Calandrinia</i> sp.	Small mammal tracks on road
		
<i>Calotis hispidula</i> (dead)	<i>Eremophila longifolia</i>	Swale

Transect F	Dune and swale. 30% vegetation cover.	
		
<i>Scaevola spinescens</i>	<i>Solanum coactiliferum</i>	<i>Triodia</i> on dunes
		
Red Kangaroo tracks	Mature <i>Triodia</i>	<i>Grevillea stenobotrya</i>
Transect G	Flattish dune crest. Scattered spinifex with overstorey of sparse hop bush and <i>Grevillea stenobotrya</i> . 30% vegetation cover.	
		
<i>Triodia</i> grassland on dune	<i>Acacia aneura</i>	
Transect H	20% vegetation cover. Spinifex, <i>Hakea leucoptera</i> , Hop Bush. Occasional low dune face.	
		
Water channel below dune	<i>Senna</i> sp.	<i>Acacia aneura</i>

APPENDIX V – LIST OF FLORA

Latin Name	Common Name	Habitat
TREES		
<i>Acacia aneura</i>	Mulga	Dunes, sandplains
<i>Acacia victoriae</i>	Elegant Wattle	Dunes, sandplains
<i>Atalaya hemiglauca</i>	Whitewood	Dunes, sandplains
<i>Corymbia terminalis</i>	Western Bloodwood	Dunes, sandplains
<i>Eucalyptus coolabah</i>	Coolibah	Dunes, sandplains
<i>Grevillea striata</i>	Beefwood	Dunes, sandplains
<i>Hakea leucoptera</i>	Needle Hakea	Dunes, sandplains
<i>Owenia acidula</i>	Sour Apple	Dunes, sandplains
<i>Santalum lanceolatum</i>	Native Plum	Dunes, sandplains
SHRUBS		
<i>Acacia ligulata</i>	Marpoo, Sandhill Wattle	Dunes, sandplains
<i>Acacia oswaldii</i>	Sandhill Wattle	Dunes, sandplains
<i>Acacia tetragonaphylla</i>	Dead Finish	Sandplains
<i>Dodonea viscosa ssp.</i>	Hop Bush	Dunes, sandplains
<i>Duma florulenta</i>	Lignum	Ephemeral wetlands
<i>Eremophila duttonii</i>	Harlequin Fuchsia	Dunes
<i>Eremophila glabra</i>	Black Fuchsia	Sandplains, clay
<i>Eremophila longifolia</i>	Weeping Emu-bush	Sandplains, clay
<i>Eremophila maculata</i>	Native Fuschia	Dunes
<i>Grevillea juncifolia</i>	Spider-flower	Sandplains
<i>Grevillea stenobotrya</i>	Sandhill Grevillea	Dune crests, swales
<i>Lysiana exocarpi</i>	Harlequin Mistletoe	Tree parasite
<i>Melaleuca interioris</i>	Broom Honey-myrtle	Ephemeral water course
<i>Scaevola spiniscens</i>	Spiny Fanflower	Sandplains, clay
<i>Senna artemesoides sp.</i>	Silver Cassia	Dunes, sandplains, gibber
<i>Solanum coactiliferum</i>	Wild Tomato	Sand, clay
FORBS/HERBS		
<i>Abutilon otocarpum</i>	Desert Chinese Lantern	Dune, sandplain
<i>Atriplex vesicaria</i>	Bladder Saltbush	Sand, clay, gibber, salt
<i>Blenodia canescens</i>	Wild Stock	Sand
<i>Calandrinia sp.</i>	Parakeelya	Dune, sand plain
<i>Calotis hispidula</i>	Bogan Flea	Sand, clay, gibber
<i>Calotis plumulifera</i>	Woolly-headed Burr Daisy	Sand, clay, gibber
<i>Chenopodium auricomum</i>	Golden Goosefoot	Swamps, claypans
<i>Croatalaria cunninghamii</i>	Parrot Pea	Dune, sand plain
<i>Croatalaria eremea</i>	Desert Rattlepod	Dune, sand plain
<i>Dissocarpus paradoxus</i>	Cannonball	Sand, clay, gibber
<i>Enchylaena tomentosa</i>	Ruby Saltbush	Dunes sand, clay, gibber

<i>Erodium crinitum</i>	Crane's Bill	Dunes
<i>Euphorbia stevenii</i>	Bottle Tree Spurge	Sand, clay
<i>Goodenia lunata</i>	Hairy Goodenia	Sand plains, gibber
<i>Swainsona campylantha</i>	Swainsona - pea flower	Sand plains, gibber
<i>Malvastrum americanum</i>	Malvastrum	Sand clay
<i>Maireana dichoptera</i>	Fissure Weed	Sand, clay
<i>Polycalymma stuartii</i>	Poached-egg Daisy	Dunes, sandplains
<i>Othonna gregorii</i>	Fleshy Groundsel	Dunes, sandplains
<i>Polycalymma stuartii</i>	Poached Egg Daisy	Sand dunes
<i>Portulaca oleracea</i>	Purslane	Clay, sand
<i>Pterocaulon sphacelatum</i>	Fruit Salad Plant	Ephemeral water course
<i>Ptilotus latifolia</i>	Silvertail	Dunes, sandplains
<i>Ptilotus polystachyus</i>	Longtails	Dunes, sandplains
<i>Ptilotus sessiflorus</i>	Crimson Foxtail	Dunes, sandplains
<i>Rhagodia spinescens</i>	Spiny Saltbush	Clay
<i>Rhodanthe corymbiflora</i>	Paper Daisy	Clay
<i>Rhodanthe floribunda</i>	Paper Daisy	Sandplains
<i>Rhodanthe moschata</i>	Musk Sunray	Floodplains, sandplains
<i>Salsola tragus</i>	Buck Bush/Roly-poly	Sand, disturbed areas
<i>Sclerolaena bicornis</i>	Goathead Burr	Gibber, clay/sand pans
<i>Sclerolaena divaricata</i>	Pale Poverty Bush	Clay, sand
<i>Sclerolaena lanicuspis</i>	Woolly-spined Burr	Gibber, clay/sand pans
<i>Sclerolaena longicuspis</i>	Long-spined Poverty Bush	Gibber, clay/sand pans
<i>Sclerolaena muricata</i>	Black Roly-poly	Gibber, clay/sand pans
<i>Sida sp.</i>	Sida	Flood plains
<i>Trichodesma zeylanicum</i>	Cattle Bush	Dunes
GRASSES		
<i>Astrelba pectinata</i>	Mitchell Grass	Gibber, floodplains
<i>Enneapogon avanaceus</i>	Bottlewasher	Sand plains
<i>Eragrostis australasica</i>	Swamp Canegrass	Swamps, claypans
<i>Eragrostis erepoda</i>	Woollybutt	Swales, sand plains
<i>Leptochloa digitata</i>	Umbrella Canegrass	Creek lines
<i>Muehlenbeckia florulenta</i>	Lignum	Swamps, floodplains
<i>Triodia basedowii</i>	Hard Spinifex	Dunes, swales
<i>Zygochloa paradoxa</i>	Sandhill Canegrass	Dune crests

APPENDIX VI – CLIMATE

The area surveyed falls within the arid zone of north-east South Australia.

A. Rainfall

The closest weather station to the survey area is Bureau of Meteorology station number 17028 at Innamincka Station. The rainfall record for this station goes back to 1883 with latest complete records being for 2017.

The annual rainfall is extremely variable but shows an upward trend over the last 135 years. This trend is still evident even when the extreme rainfall years of 1974 and 2010 are excluded.

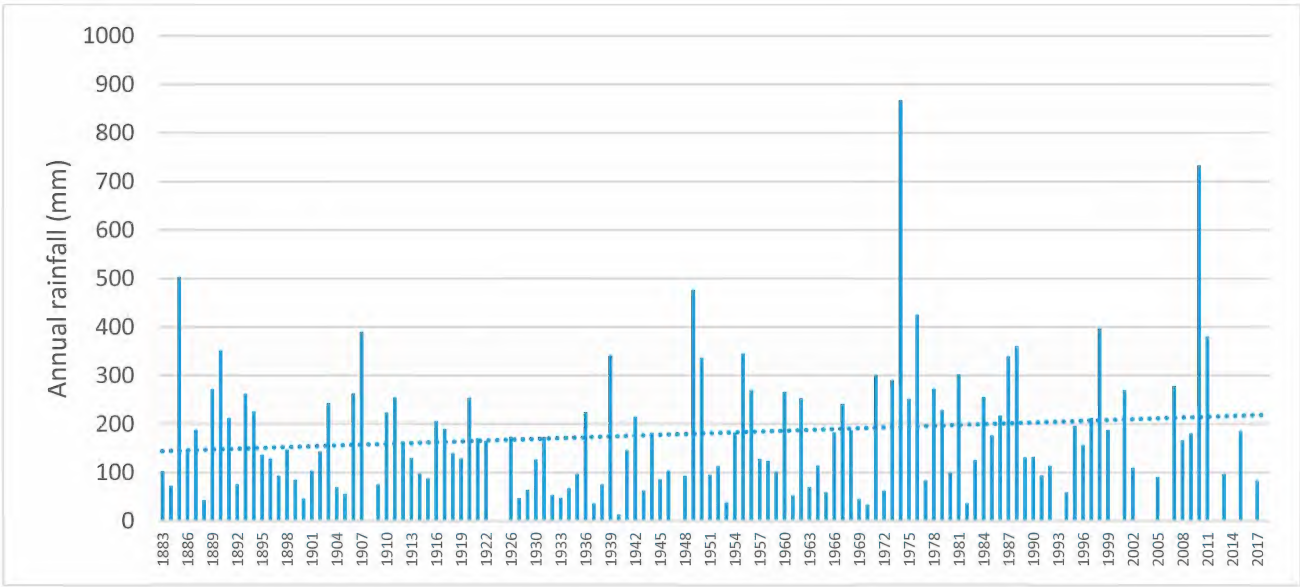


Fig. 5. Innamincka Station rainfall total per year and linear trend 1883-2017
Source: Bureau of Meteorology (BOM)

Note: Missing years due to incomplete BOM data sets: 1908, 1923, 1924, 1925, 1947, 1993, 2000, 2003, 2004, 2006, 2012, 2014, 2016, 2018. However, the rainfall records at the Innamincka Regional Reserve’s headquarters (3 km from the official Innamincka Station BOM site) showed a total of 48 mm in 2014 and 304 mm in 2016. For 2018, these charts showed a total of 5.6 mm recorded for January, 15 mm for March and 24.9 mm for June leading up to the survey. The meteorology station at Moomba Airport, 66 km south of Innamincka, recorded an annual total of 91.8 mm in 2018 of which 62 mm fell in January and 10 mm in June.

B. Temperature

The closest weather station to the survey area that records temperature is Bureau of Meteorology station number 17123 at Moomba. The temperature records go back to 1996.

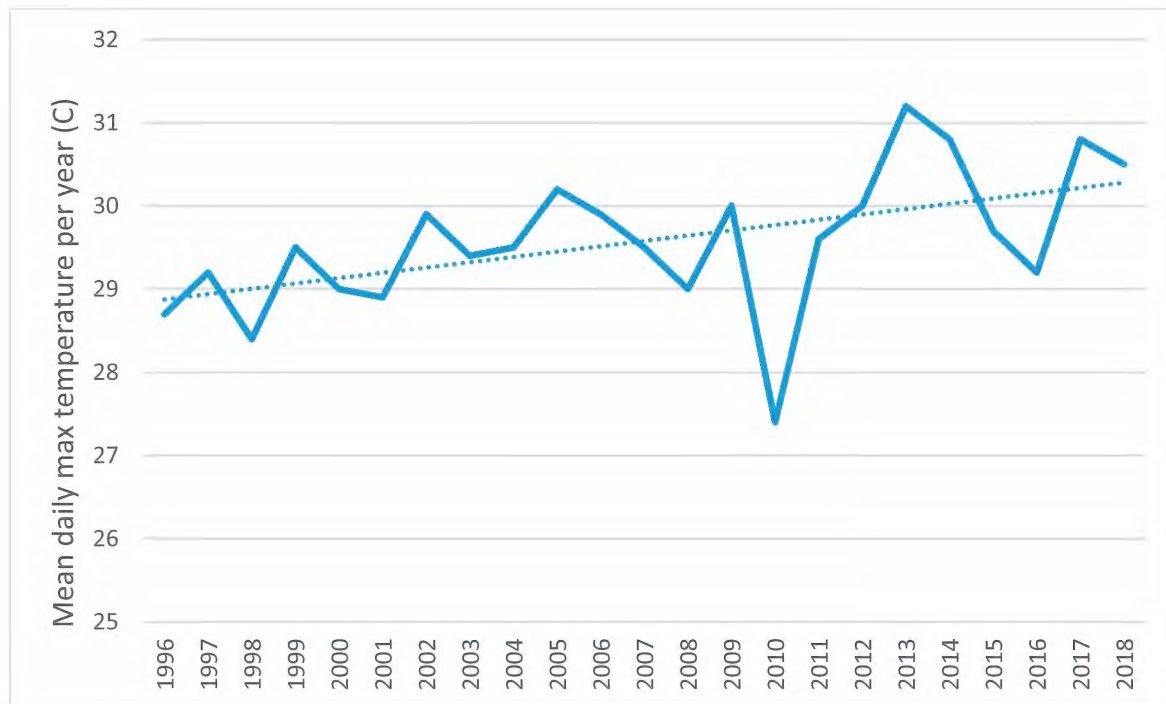


Fig. 6. Moomba Airport (17123) mean daily maximum temperature 1996-2018 with trend

Source: Bureau of Meteorology

There has been an upward trend in mean daily maximum temperature per year over the period records have been collected i.e. since 1996.

APPENDIX VII – USING A GPS TO NAVIGATE TRANSECT SQUARES

Each survey team needs to have at least one member with a GPS unit and some basic skills in using it. Given that a variety of GPS units will be brought to the survey task by different volunteers, the following guidelines are generic in nature.

Two alternative methods are given below for navigating the two transect squares for each census stop.

Preliminary Skills

Users should come to the task knowing how to:

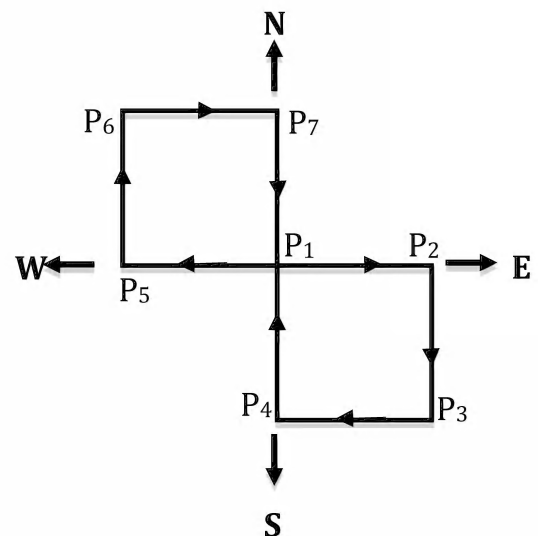
1. set up their GPS units to locate positions using
 - (a) metric units
 - (b) UTM position format
[for the Innamincka area the UTM zone/band is 54 J and the position is given by a 6 or 7 digit **easting** (depending on whether or not the leading zero is shown) and a 7 digit **northing**. E.g. 54 J 0467632 6929509. These numbers may appear on two lines, with the easting on the top line. The “54 J” may or may not be shown]
2. mark and find waypoints
3. show, not necessarily on the same page/screen
 - (a) the easting and northing for the current position
 - (b) the distance from a given waypoint

METHOD 1

Navigating Transect Squares

Starting at census stop 1 corner point 1 (P₁ in the diagram), the survey consists of two transect squares with the 500 m sides oriented along the principal compass directions as shown.

1. Mark P₁ as a waypoint on the GPS unit (e.g. call it waypoint 101). Record the easting and northing in a notebook (see Table below).
2. Select “Find” or “GoTo” waypoint 101 – your unit should tell you that you are already there!
3. Walk in an easterly direction by keeping the northing constant (you may need to adjust it by veering southwards to reduce the northing to the desired value, or by veering northwards to increase the northing to the desired value). It is not necessary to be exactly due east of P₁ at all times so it is quite OK to make detours around obstacles such as thorn bushes!
4. While proceeding eastwards, check your distance from P₁ from time to time. When this distance approaches 500 m adjust your position so that your northing is exactly the same as at P₁ and your distance from P₁ is exactly 500 m. Mark this point as P₂ (e.g. waypoint 102) and record the easting and northing in your notebook.
5. Repeat the above process to locate P₃, 500 m south of P₂. This time you will need to keep the easting constant and the northing will decrease as you go.
6. Repeat the above process for each side of the two transect squares.



Notes

- Eastings get larger as you move eastwards and smaller as you move westwards. Northings get larger as you move northwards and smaller as you move southwards.

- A possible format for your record book is shown. Note that eastings and northings are alternatively equal as you move from one point to the next.

Census stop 1 Waypoints

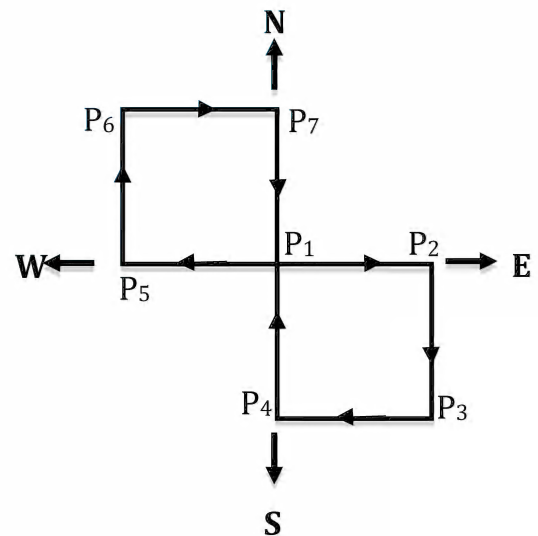
Waypoint	Easting	Northing
101 (P ₁)	a	b
102 (P ₂)	c	b
103 (P ₃)	c	d
104 (P ₄)	a	d
101 (P ₁)	a	b
105 (P ₅)	e	b
106 (P ₆)	e	f
107 (P ₇)	a	f
101 (P ₁)	a	b

METHOD 2

Navigating Transect Squares

Starting at census stop 1 corner point 1 (P₁ in the diagram), the survey consists of two transect squares with the 500 m sides oriented along the principal compass directions as shown.

1. Mark P₁ as a waypoint on the GPS unit (e.g. call it waypoint 101). In a notebook draw up a table as shown below and record the easting ('*e*') and northing ('*n*') of P₁.
2. Calculate the eastings and the northings for the other seven corner points of the survey squares by adding or subtracting 500 as shown by the formulas in the table. Enter all eastings and northings on your table.



Census Stop 1 Waypoints

Waypoint	Easting	Northing
101 (P ₁)	<i>e</i>	<i>n</i>
102 (P ₂)	<i>e</i> +500	<i>n</i>
103 (P ₃)	<i>e</i> +500	<i>n</i> -500
104 (P ₄)	<i>e</i>	<i>n</i> -500
101 (P ₁)	<i>e</i>	<i>n</i>

105 (P₅)	$e-500$	n
106 (P₆)	$e-500$	$n+500$
107 (P₇)	e	$n+500$
101 (P₁)	e	n

3. Walk in an easterly direction by keeping the northing constant (you may need to adjust it by veering southwards to reduce the northing to the desired value, or by veering northwards to increase the northing to the desired value). It is not necessary to be exactly due east of P₁ at all times so it is quite OK to make detours around obstacles such as thorn bushes!
4. While proceeding eastwards, monitor the easting of your current position. When this approaches the desired easting ($e+500$) adjust your position so that your northing is exactly the same as at P₁ (n) and your easting is exactly ($e+500$). You have now reached the point P₂ (waypoint 102).
5. Repeat the above process to locate P₃, 500 m south of P₂. This time you will need to keep the easting constant and the northing will decrease as you go.
6. Repeat the above process for each side of the two transect squares.

Note

- Eastings get larger as you move eastwards and smaller as you move westwards. Northings get larger as you move northwards and smaller as you move southwards.
- Example calculation:

Census Stop 1 Waypoints

Waypoint	Easting		Northing	
101 (P₁)	e	0431028	n	6953816
102 (P₂)	$e+500$	0431528	n	6953816
103 (P₃)	$e+500$	0431528	$n-500$	6953316
104 (P₄)	e	0431028	$n-500$	6953316
101 (P₁)	e	0431028	n	6953816
105 (P₅)	$e-500$	0430528	n	6953816
106 (P₆)	$e-500$	0430528	$n+500$	6954316
107 (P₇)	e	0431028	$n+500$	6954316
101 (P₁)	e	0431028	n	6953816

While it would be possible to manually input these co-ordinates into the GPS unit and to then use the “Find” or “GoTo” function, the process would be time-consuming and tedious and the following of the direction arrow is not likely to give a more precise transect square than the method of maintaining eastings and northings detailed above.

APPENDIX VIII - EQUIPMENT LIST

- EPIRB (if you have one) or Satellite phone (if you have one)
- Hand-held UHF radio for staying in contact while surveying (*to be carried on your person at all times when out of the car, along with at least one set of spare batteries*)
- GPS for each group (*to be carried at all times when out of the car, along with at least one set of spare batteries*)
- Compass (*to be carried on your person at all times when out of the car*)
- Plenty of spare batteries
- Survey sheets and a clip board, notebook and pencils
- Watch for telling the time (or use GPS clock)
- Digital camera with large memory card. Set camera clock to local time to enable you to better relate photos to location.
- Small ruler or measuring card for photographing with tracks etc.
- Car chargers for the various pieces of electronic equipment / rechargeable batteries
- Star picket / dropper, plastic dropper cap, star dropper plunger
- Census stop marker plate stamped for census stop e.g. FOIR CS01, bolt, washer and nut, spanner
- Personal protective equipment (PPE)
- First Aid kit including snake bite kit